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Forest Service

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National Forest

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Chasina Timber Sale

Draft Environmental Impact Statement

Volume I

Acronymns And Symbols

ADF&G	Alaska Department of Fish and Game
AHMU	Aquatic Habitat Management Unit
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
ASQ	Allowable Sale Quantity
BBF	One Billion Board Feet
BMP	Best Management Practice
CEQ	Council on Environmental Quality
CFL	Commercial Forest Land
CFR	Code of Federal Regulations
CZMA	Coastal Zone Management Act of 1976
DBH	Diameter at Breast Height
DEIS	Draft Environmental Impact Statement
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EVC	Existing/Expected Visual Condition
FEIS	Final Environmental Impact Statement
FSH	Forest Service Handbook
FSM	Forest Service Manual
GIS	Geographic Information System
IDT	Interdisciplinary Team
KPC	Ketchikan Pulp Company
KV	Knutsen-Vandenberg Act
LTF	Log Transfer Facility
LUD	Land Use Designation
LWD	Large Woody Debris (same as LOD)
MBF	One Thousand Board Feet
MELP	Multi-Entry Layout Process
MIS	Management Indicator Species
MM	Maximum Modification
MMBF	One Million Board Feet
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
P	Primitive
PR	Partial Retention
R	Retention
RM	Roaded Modified
RN	Roaded Natural
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
SHPO	State Historic Preservation Officer
SPM	Semi-Primitive Motorized
SPNM	Semi-Primitive Nonmotorized
TLMP	Tongass Land Management Plan
TRUCS	Tongass Resource Use Cooperative Survey
TTRA	Tongass Timber Reform Act
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFWS	United States Fish and Wildlife Service
VCU	Value Comparison Unit
VQO	Visual Quality Objective
WAA	Wildlife Analysis Area

Acknowledgments

Front cover: By Cindy Ross Barber, 1992. The design illustrates the range of interconnected issues addressed in the EIS

Draft Environmental Impact Statement

Chasina Timber Sale

United States Department of Agriculture
Forest Service-Alaska Region
Alaska

Lead Agency:	U.S.D.A. Forest Service Tongass National Forest Ketchikan Administrative Area
Responsible Official:	Forest Supervisor Ketchikan Administrative Area Tongass National Forest Federal Building Ketchikan, Alaska 99901
For Further Information Contact:	Norm Matson, Planning Biologist Ketchikan Administrative Area Tongass National Forest Federal Building Ketchikan, Alaska 99901 907 228-6273

Abstract

The USDA Forest Service proposes to harvest approximately 50 million board feet (MMBF) of timber in the Chasina Project Area, Craig Ranger District, Ketchikan Administrative Area, Tongass National Forest. Timber volume would be offered through the Ketchikan Area timber sale program. The actions analyzed in this EIS are designed to implement direction contained in the Tongass Land Management Plan (TLMP, 1979a, as amended) and the Tongass Timber Reform Act. The EIS describes six alternatives which provide different combinations of resource outputs and spatial locations of harvest units. The alternatives include: 1) No Action, proposing no new harvest from the Project Area at this time; 2) configure harvest units to emphasize wildlife habitat and maintain the integrity of large unfragmented blocks of old-growth forest; 3) configure harvest units to emphasize a positive net economic return, while seeking to strike a balance between competing resource uses; 4) optimize the amount of timber offered while keeping the amount of new road construction to a minimum; 5) configure harvest units to emphasize timber sale economics and conventional cable yarding methods; and 6) configure harvest units to provide the maximum amount of timber within Forest Plan Standards and Guidelines.

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Outline

Chapter 1

Purpose and Need

Key Terms

Allowable Sale Quantity (ASQ)—the maximum quantity of timber that may be sold each decade from a National Forest.
Land Use Designation (LUD)—method of classifying land uses, allocated by the Forest Plan
MMBF—million board feet.
Management Area—an area for which management direction was written in the Forest Plan (TLMP 1979a, as amended 1986). Management areas encompass one or more Value Comparison Units (VCUs).
Offering—Forest Service specification of timber harvest units, subdivisions, roads, and other facilities and operations to meet the requirements of a contract.
Old-growth Forest—an ecosystem distinguished by old trees and related structural attributes. Old-growth forests encompass the latter stages of stand development. They typically differ from earlier stages of stand development in a variety of characteristics which may include tree size, accumulation of large dead woody material, number of canopy layers, tree species composition, and ecosystem function.
Scoping Process—activities used to determine the scope and significance of a proposed action, what level of analysis is required, what data is needed, and what level of public participation is appropriate.
Tongass Land Management Plan (TLMP)—the 10-year land allocation plan for the Tongass National Forest, also known as the Forest Plan. The TLMP was completed in 1979 and was amended in 1986 and again in 1991 (TLMP 1979a, as amended). The TLMP is currently undergoing revision; the Draft Environmental Impact Statement (DEIS) for the Proposed Revised Forest Plan was issued in 1990; a supplement to the TLMP Revision DEIS was issued in 1991 (TLMP Revision Supplement DEIS 1991a); and a Revised Supplement to the TLMP Revision Supplement DEIS was issued in 1996 (Revised Supplement Draft TLMP EIS 1996a). Reference in the Chasina EIS to the Revised Supplement Draft TLMP EIS (TLMP RSDEIS, 1996a) is to the DEIS as proposed to be implemented in the Preferred Alternative of the Revised Supplement, unless otherwise noted. Until the Forest Plan Revision is completed, the TLMP (1979a, as amended) remains in effect.
Value Comparison Unit (VCU)—areas which generally encompass a drainage basin to provide a common set of areas where resource inventories could be conducted and resource interpretations made.

Introduction

In compliance with the National Environmental Policy Act (NEPA) and other relevant State and Federal laws and regulations, the Forest Service has prepared this Environmental Impact Statement (EIS) on the effects of timber harvest in the Chasina Project Area (Figure 1-2) on Prince of Wales Island of the Ketchikan Administrative Area, Tongass National Forest. The proposed action would make approximately 50 million board feet (MMBF) of timber available to the Ketchikan Area timber sale program. This EIS discloses the direct, indirect, and cumulative environmental impacts and any irreversible or irretrievable commitment of resources that would result from each proposed alternative.

Decision to be Made

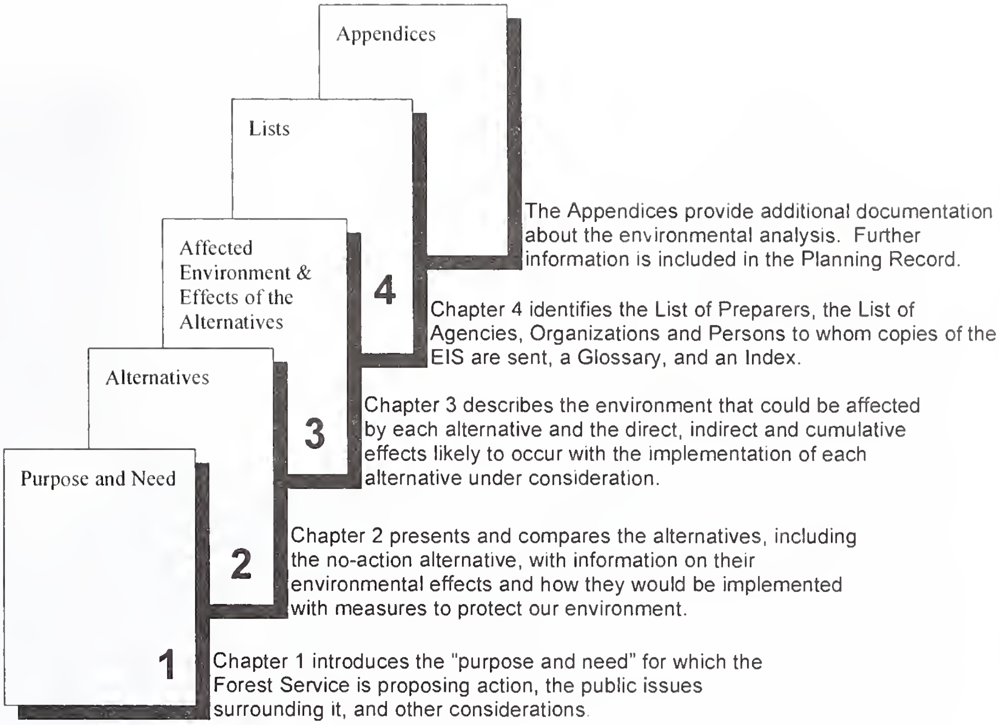
Based on the environmental analysis, the Ketchikan Area Forest Supervisor must decide whether or not and, if so, how to make timber available from the Chasina Project Area in accordance with the implementation of the Tongass Land Management Plan (TLMP). The decisions will include:

- the volume of timber to make available in this area, in one or more timber offerings;
- the locations of timber harvest units;
- the locations of arterial and collector roads;
- necessary standards and guidelines, mitigation measures, and enhancement opportunities for sound resource management;
- whether there may be a significant restriction on subsistence uses.

Document Organization

This EIS is prepared according to the format (Figure 1-1) established by Council on Environmental Quality (CEQ) regulations (40 CFR 1500-1508) implementing NEPA. Chapter 1, in addition to explaining the purpose and need for the proposed action, discusses how the Chasina Project relates to the Forest Plan and to other related NEPA actions, the key issues driving the EIS analysis, and the authorities guiding the EIS process. Chapter 2 describes and compares the alternatives for accomplishing the proposed action and no-action alternatives. Chapter 3 describes the potentially affected environment and the anticipated effects of the alternatives on the natural and human environment in the project area and those areas directly affected by the proposed action. Chapter 4 contains the list of preparers, distribution list, glossary, index, and cited literature. Finally, a series of appendices provides helpful references to understanding the EIS. Additional documentation may be found in the project Planning Record located at the District Ranger's office in Craig.

Figure 1-1
How This Document is Organized



Project Area

The 68,927 acre Chasina Project Area is located approximately 25 air miles southwest of Ketchikan, Alaska (Figure 1-2). It encompasses an area south of Cholmondeley Sound on Prince of Wales Island extending from South Arm east all the way out to Chasina Point. There are no communities within or adjacent to the project area. Access to the project area is by small plane or boat generally originating in Ketchikan.

The project area includes Tongass Land Management Plan (TLMP 1979a, as amended) Management Area K18, Polk Inlet, Management Area K24, South Arm/Lancaster Cove, and Management Area K25, North Arm Moira. The Polk Inlet Management Area includes value comparison unit (VCU) 674. The South Arm/Lancaster Cove Management Area includes VCUs 677, 678, 679, 680, and 681. The North Arm Moira Management Area includes VCU 682. VCU boundaries generally follow major watershed divides with a few minor exceptions.

Figure 1-2
Project Area Vicinity Map

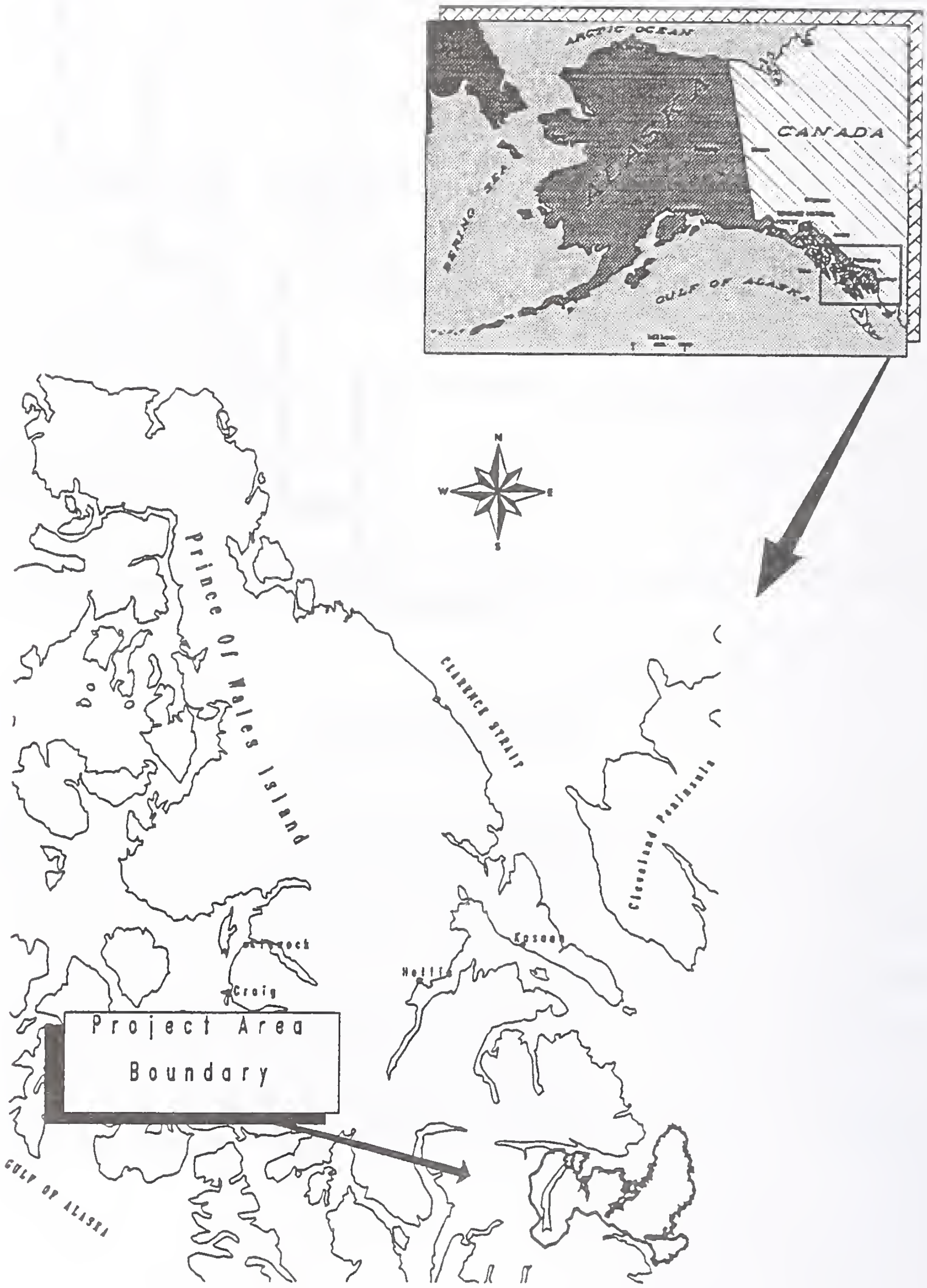
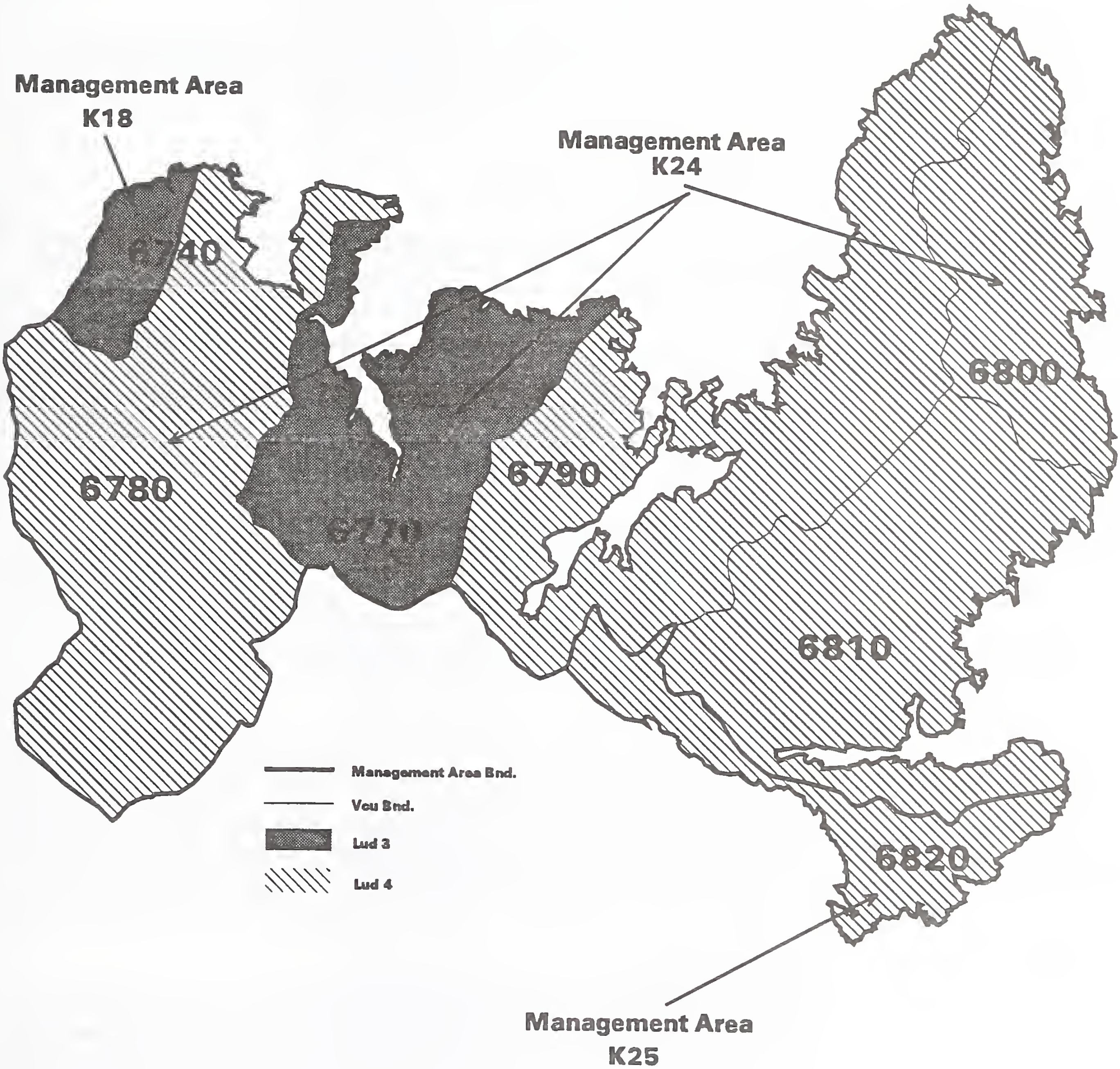


Figure 1-3
Management Area and VCU Boundaries



Proposed Action

The proposed action would harvest approximately 40 MMBF of timber from an estimated 2,000 acres through a series of offerings beginning in 1998. Timber sale offerings from this harvest will be made available to the Ketchikan Area Timber Sale Program. Approximately 11 miles of existing road would be reconstructed and 40 miles of new road would be built to facilitate timber removal. One existing log transfer facility (LTF) and two newly constructed facilities could be utilized to implement the action alternatives.

The proposed action is consistent with implementation of the Forest Plan known as the Tongass Land Management Plan (TLMP 1979a, as amended), thereby moving from the existing forest condition toward the desired future condition.

Purpose and Need

The purpose and need for this project is to implement direction contained in the Tongass Land Management Plan (TLMP 1979a, as amended), to help provide a sustained level of timber supply to meet annual and TLMP planning cycle market demand, and to provide local employment in the woods products industry, consistent with providing for the multiple use and sustained yield of all renewable forest resources. The alternatives and actions considered are possible approaches to meeting this purpose and need. The EIS study process was designed to help insure that, in meeting this purpose and need, the Forest Service makes the most informed decision possible for this project area specifically, and for the Tongass National Forest generally. The Chasina Project is expected to provide up to approximately 50 MMBF of timber, given the guidance of the Forest Plan.

Implement TLMP

Under TLMP, the project area has been given Land Use Designation (LUD) IV, with an exception for the two harvest units in VCU 674, which are LUD III. The TLMP schedules timber sale preparation for all Management Areas in the project area. A comparison of the Desired Future Condition for the project area, as reflected in TLMP direction, with the existing condition shows the need to convert suitable stands of old growth to managed productive stands capable of long-term timber production.

TLMP Revision

Alternatives developed for the Chasina Project took into account the LUDs and standards and guidelines that were being analyzed for the Preferred Alternative (Alternative 3) for the TLMP RSDEIS (1996a). This includes 500 foot beach buffers, 1,000 foot estuary buffers, blocks of Old-growth Habitat Reserves in the vicinity of South Arm Cholmondeley Sound and the area between Kitkun Bay and North Arm Moira Sound, areas managed for Modified Landscape (VCUs 674 and 682), and the current land status (some land has been recently conveyed to Kootznoowoo Native Corporation). The rest of the project area is to be managed for timber production.

Timber Demand

Section 101 of the Tongass Timber Reform Act of 1990 (TTRA), directs the USDA Forest Service "... to the extent consistent with providing for the multiple use and sustained yield of all renewable forest resources, seek to provide a supply of timber from the Tongass National Forest which (1) meets the annual market demand for timber from such forest and (2) meets

the market demand from such forest for each planning cycle." Section 101 of the TTRA specifies that Forest Service efforts to seek to meet market demand are subject to appropriations, National Forest Management Act (NFMA) requirements, and other applicable laws. Providing a timber supply from the Tongass for sustained local wood products industry employment and related economic and social benefits is an objective of the TLMP and the Alaska National Interest Land Conservation Act (ANILCA), as amended by the TTRA.

There is demonstrated mill capacity in the region to process logs, if a supply of timber is available. There is also a projected need for the timber volume being considered from this project area for the Forest Service to come closer to meeting an objective of providing a three-year supply of timber under contract to the existing dependent industry (see Appendix A), as a means of providing for stability in relation to fluctuating market demand (Morse, 1995). There is a substantial component of the economy of Southeast Alaska that is dependent on a viable timber industry. Based on these factors, the need for the project is clearly indicated.

Reasons for Scheduling the Environmental Analysis of the Chasina Project Area

Reasons for scheduling the Chasina Project Area at this time, for detailed consideration of timber harvest under the Ketchikan Area timber sale program, may be summarized as follows:

- The Chasina Project Area contains a sufficient amount of harvestable timber volume designated as LUD III or IV, and is therefore appropriate for harvest under the Tongass National Forest Land Management Plan (TLMP). Available information indicates harvest of the amount of timber being considered for this project can occur consistent with TLMP standards and guidelines and other requirements for resource protection. Analysis also indicates harvest of the amount of timber being considered can occur consistent with the proposed TLMP Standards and Guidelines and other resource protection requirements.

- Areas with available timber both within and outside the designated sale area will also be necessary to consider for harvest in order to seek to provide a supply of timber from the Tongass National Forest which (1) meets the annual market demand for timber from such forest and (2) meets the market demand from such forest for each planning cycle, pursuant to Section 101 of the Tongass Timber Reform Act (TTRA).

- Effects on subsistence resources are projected to differ little according to which sequence these areas are subjected to harvest. Harvesting other areas on the Tongass National Forest with available timber is expected to have similar potential effects on resources, including those used for subsistence because of widespread distribution of subsistence use and other factors. Harvest of these other areas is foreseeable, in any case, over the forest planning horizon under either the existing or proposed revised TLMP.

- Providing substantially less timber volume than required to meet TLMP and TTRA Section 101 timber supply and employment objectives in order to avoid harvest in the Chasina Project Area or other project areas would not meet contract requirements and is otherwise not necessary or reasonable.

- It is reasonable to schedule harvest in the Chasina Project Area at the present time rather than other areas in terms of previous harvest entry and access, level of controversy over subsistence and other effects, and the ability to complete the National Environmental Policy Act (NEPA) process and make timber available. Other areas that are reasonable to consider for harvest in the near future are the subject of other project EISs that are currently ongoing or scheduled to begin soon.

Additional information about why the Chasina area was selected is provided in Appendix A.

Existing and Desired Future Condition

The existing condition of the project area is described in Chapter 3 of this EIS, in the "Affected Environment" portion of each resource section. A moderate amount of timber harvest occurred inside the project area around Lancaster Cove/Kitkun Bay in 1989-90. The project area contains 26,141 acres of commercial forest land, of which 24,178 acres of old growth remain. Recreation use within the project area focuses on water related activities. Known land-based subsistence use has been low.

The desired future condition, as specified in the Management Direction/Emphasis for each management area, was established through the Forest planning process and is presented in the TLMP, (1979a, as amended). This management direction contained goals for timber, recreation, visuals, fish, wildlife, and other resources. It is anticipated that more than half of the Forest will remain in a basically unmodified state over time, if current land use designations remained the same. For specific management emphasis and direction for each management area in the Chasina Project Area, see TLMP as amended in 1985-86 (USDA Forest Service 1986, Doc. 147).

The management emphasis and direction was further refined as the Desired Future Condition in the TLMP Draft Revision. This desired future condition consists of a mosaic of timber stands of varying sizes and ages, interspersed with areas of old growth and nonforest vegetation, furnishing a sustained yield of timber in balance with other resources and uses.

Achievement of the desired future condition as described in the TLMP RSDEIS (1996a) will require many decades. It will be reached by applying integrated resource management practices that are responsive to site specific, on-the-ground conditions. Roaded access would be provided for suitable timber lands. Harvested old-growth timber sites will be converted to successive stands of younger trees which will produce higher average volumes per acre than existing stands. Timber, including saw logs and utility volume, will have contributed to the Forest allowable sale quantity (ASQ).

Riparian areas will be managed to benefit riparian dependent resources. Water quality will continue to meet or exceed state standards. Fish habitat conditions will be maintained or improved. Sensitive visual resources, particularly as viewed from saltwater, will be consistent with the proposed visual quality objectives (VQOs).

Recreation opportunities will continue to be associated with float plane and boat access from saltwater. Primitive recreation opportunities will be reduced, but dispersed and developed recreation opportunities associated with roads will be maintained or improved.

Old-growth stands will be reduced in the project area but unsuitable lands, beach fringe, estuary, and stream protection zones, in addition to adjacent large blocks of old growth (Nutkwa LUD II area and the South Prince of Wales wilderness area), will be retained. Old-growth associated species such as hairy woodpecker, marten, Vancouver Canada goose,

river otter, and Sitka black-tailed deer will continue to be adequately represented. Management may be adjusted to accommodate any verified use of the area by threatened, endangered, and sensitive species in accordance with recovery habitat maintenance and objectives.

The Decision Making Process

National Forest planning involves several levels of decision. Decision making begins with long-range planning at the national level, continuing down through the regional and forest levels to the project level. The Chasina Project is part of this process. This EIS is a project-level analysis; as such, it does not attempt to address decisions made at higher levels. It does, however, implement direction provided at those higher levels. Specifically, the Chasina Project would implement direction in the Forest Plan (TLMP, 1979, as amended).

National Level

The 1990 Program and Assessment, as directed by the Forest and Rangeland Renewable Resources Planning Act of 1974 (Resources Planning Act) as amended, provides national direction for resource allocations and targets. An assessment of the forest and rangeland renewable resources is required every ten years, and development of a program for managing those resources is required every five years. The Resources Planning Act program provides Congress with a basis to link annual budgets with long-term resource needs.

Regional Level

The Alaska Regional Guide EIS (1983), addressed regional issues specific to Alaska, established management standards and guidelines, and displayed resource outputs for the Tongass National Forest. The Forest Plan takes into account this regional direction.

Forest Level

The National Forest Management Act of 1976 (NFMA) directs each National Forest to prepare an overall plan of activities. The Forest Plan provides land and resource management direction for the Forest. It establishes LUDs to guide management of the land for certain uses. The LUDs describe the activities that may be authorized within the Value Comparison Units (VCUs), the boundaries of which usually follow easily recognizable (major) watershed divides.

For the Tongass National Forest, the Forest Plan is the Tongass Land Management Plan (TLMP) of 1979, as amended in 1986, and again in February 1991, as a result of the Tongass Timber Reform Act (TTRA). The Forest Plan is currently undergoing revision, as required by the NFMA. A supplement to the TLMP Draft EIS was issued in 1991 (USDA Forest Service 1991a). A Revised Supplement to the 1991 SDEIS was issued in 1996 (USDA Forest Service 1996a). Until the Record of Decision (ROD) for the Revision is signed, the TLMP (1979a, as amended) remains in effect.

Project Level

Other Projects

The Polk Inlet EIS was the most recent EIS within portions of the project area. It provided 113 MMBF of timber which is being prepared for offer. None of the selected Polk Inlet ROD harvest units were located within the Chasina Project boundary.

Current Project

The Chasina EIS presents a broad range of alternatives and displays site-specific descriptions and impacts of the proposed activities of six alternatives.

1 Purpose and Need

This EIS is "tiered" to the TLMP EIS 1979a, as amended in 1986 and 1991 as permitted by 40 CFR 1502.20.

This EIS also tiers to the Alaska Regional Guide EIS, 1983.

Relevant discussion from the following documents has been incorporated by reference rather than repeated (40 CFR 1502.21):

This EIS proposes management consistent with the TLMP RSDEIS (1996a), Preferred Alternative. Documented forest-wide analyses in TLMP (1979, as amended) or the TLMP RSDEIS (1996a) are referenced rather than repeated in this EIS.

This EIS makes no recommendations for site-specific amendments to the Forest Plan in the form of land allocations to provide old-growth habitat conditions or management for visual quality. Such decisions are made by the Forest Plan.

The Interdisciplinary Team (IDT) used a systematic approach to analyze the proposed project, estimate the environmental effects, and prepare this EIS. The planning process complies with the National Environmental Policy Act (NEPA). Planning was coordinated with affected Federal, State, local agencies, and local federally recognized tribes.

TLMP, as Amended

Land Use Designations

The current TLMP (1979a, as amended) designates areas appropriate for various activities through four Land Use Designations (LUD). The proposed TLMP RSDEIS (1996a) would provide more specific management direction by subdividing the project area into refined LUDs and by applying specific standards and guidelines. This EIS also utilizes the standards and guidelines presented in the TLMP RSDEIS (1996a).

The Chasina Project Area is allocated to LUD IV and LUD III as described below. Full definitions of all LUDs are presented in the current TLMP (1979a, as amended).

LUD IV

Areas allocated to LUD IV provide opportunities for intensive development of resources. Emphasis is primarily on commodity or market resources and their uses. Amenity values are also considered. When conflicts regarding competing resource use arise, resolution most often would be in favor of commodity values. Allowances in calculated potential timber yields have been made to provide for protection of physical and biological productivity. Specifics include:

- Timber is to be harvested primarily by clearcutting;
- Potential timber yields are to be reduced only to the extent necessary to protect the biological and aesthetic values;
- Mineral development is subject to existing laws and regulations;
- Permanent or temporary roads may be built;
- Motorized use is permitted;
- A full range of recreational facilities is permitted;

- A full range of fisheries improvement projects are permitted; and
- Needed trails can be provided.

The project area contains 41,428 acres of LUD IV lands in VCUs 677, 678, 679, 680, 681, and 682.

LUD III

LUD III areas are managed to provide a combination of both amenity and commodity values. The goal is to achieve compatibility among competing resource uses within the same area. Specifics include:

- Potential timber yields will be reduced to the extent needed to protect important biological and aesthetic values;
- Both permanent and temporary roads are allowed;
- Roads are located and designed so as to retain important recreational and scenic qualities;
- Needed trails can be provided;
- A full range of recreational facilities is permissible;
- A full range of fisheries improvements projects is permitted.

The project area contains 1,923 acres of LUD III lands in VCU 674.

TLMP Revision

The TLMP RSDEIS (1996a) would refine the Land Use Designations. For example the existing LUD III lands in VCU 674 would be managed as Modified Landscapes (ML). The TLMP RSDEIS supplements management direction through detailed management prescriptions and standards and guidelines. There are 19 LUDs identified in the TLMP RSDEIS, three of which apply to the Chasina Project Area. References in this document to the TLMP RSDEIS will mean the Preferred Alternative of the Revised Supplement Draft Tongass Land Management Plan EIS (1996a) unless otherwise noted. The TLMP RSDEIS LUDs and other land ownerships allocated in the project area are described below.

Minerals (MM)
Encourage mineral exploration and development of areas with high mineral potential.

Old-Growth Habitat (OG)
Maintain old-growth forests in a natural or near-natural condition for wildlife and fish habitat.

Modified Landscape (ML)
The emphasis of this LUD is to provide for natural-appearing landscapes while allowing timber harvest.

Timber Production (TM)
The emphasis of this LUD is to manage the area for industrial wood production. It promotes conditions favorable for the timber resource and for maximum long-term timber production.

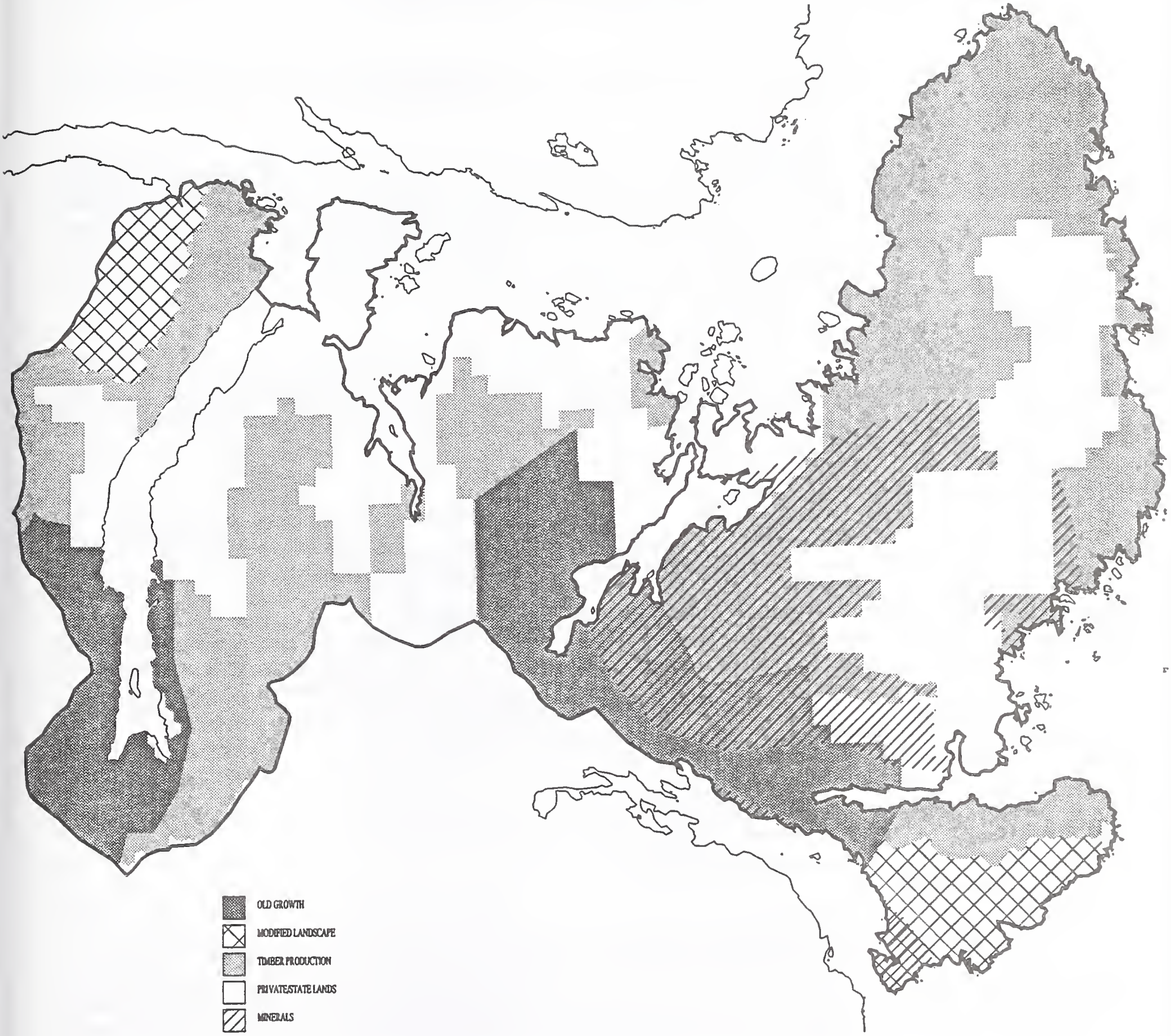
Table 1-1 displays the Management Areas and management prescriptions within the project area, the VCUs, and the corresponding acres associated with each Land-Use Allocation. Figure 1-4 displays the location of the TLMP RSDEIS (1996a) proposed land allocations within the Chasina Project Area.

Table 1-1
Land Use Designations as Defined in TLMP RSDEIS (1996a)

Management Area	VCU	ML	TM	OG	MM	Total Acres
K18	674	1,901				1,901
K24	677, 678, 679, 680, 681	20	31,067	9,952	(9,346)	41,039
K25	682	2,544	40	1,783	(1,027)	4,367
Total Acres Excluding Saltwater		**4,465**	**31,107**	**11,735**		**47,307**

ML—Modified Landscape
TM—Timber Production
OG—Old-growth Habitat
MM—Minerals (Minerals LUDs will overlap other LUDs)
Note: Discrepancies may be found between tables due to rounding

Figure 1-4
Chasina Project Area Land Allocations as proposed in TLMP RSDEIS (1996a)



Public Involvement

Scoping

The NEPA process (40 CFR 1501.7) was used to determine the scope of the issues to be addressed and identify major concerns related to the proposed action. The scoping process was used to invite public participation and collect initial comments. The public was invited to comment on the project through the following process.

Notice of Intent (NOI)

A Notice of Intent was published in the Federal Register on November 2, 1995, when it was decided that an EIS was to be completed for the project.

Public Mailing

On October 30, 1995, a letter providing information and seeking public comment (scoping document) was mailed to approximately 300 individuals and groups that had previously shown interest in Forest Service projects in Southeast Alaska. The mailing included Federal agencies, State agencies and divisions, Native and municipal offices, and businesses and other organizations and groups, in addition to individual citizens. Approximately 104 responses to this initial mailing were received.

Local News Media

Announcements about the project were printed in the *Ketchikan Daily News*, *Island News*, *Wrangell Sentinel*, *Sitka Sentinel*, *Petersburg Pilot*, and *Juneau Empire*. A scoping document describing the project was placed in the October 27, 1995, edition of the *Ketchikan Daily News*.

Briefings

Additional briefings were held to provide information and clarification on issues and alternatives with individuals and organizations. Consultation with local, state, federal, and local tribal government agencies also occurred during this time.

Draft EIS

Availability of Draft EIS for Public Comment

Release of the Draft EIS will initiate a minimum 45-day comment period during which time written or verbal comments will be welcomed from interested parties. The period for public comment on this draft EIS and the deadline for receipt of written comments are identified in the cover letter accompanying this document and will be published in the local media. Written comments on this EIS should be mailed to:

Forest Supervisor
ATTN: Chasina EIS
Tongass National Forest
Federal Building
Ketchikan, AK 99901

Subsistence Hearings

Subsistence hearings on the Draft EIS will be held in the communities of Hydaburg and Saxman, Alaska. Open houses will be held in conjunction with the subsistence hearings to describe the analysis process and answer public questions on the Draft EIS. Public comment on the Draft EIS will also be accepted at that time. Dates, times, and locations are included in the cover letter accompanying this document and will be publicized in the local media.

Final EIS

Analysis and Incorporation of Public Comments

Public comments and subsistence comments will be analyzed and incorporated into the Final EIS. A final EIS is projected to be released in April 1997, along with a ROD that will summarize the alternatives considered and will state which one is to be implemented. The ROD will also summarize measures to mitigate adverse environmental impacts and applicable project monitoring.

Issues

Issues Associated with the Proposed Action

The significant public issues, management concerns, and resource opportunities identified through the public and internal scoping process were used to formulate issues statements. Some of these issues were raised by the public, and some reflect Forest Service concerns. Similar issues and concerns were grouped when appropriate.

Issues 1 through 8 were determined to be significant and within the scope of the project. All these issues will be addressed in all alternatives. Issues A-E were considered but eliminated from detailed study because their resolution falls outside the scope of the Chasina project.

Issue 1: Timber Economics and Supply

The issue encompasses public concern with the amount of timber available and proposed for harvest, methods of timber harvest, whether timber harvest should be continued, and balancing timber production with other Forest uses. It includes the issue of how the project area contributes to the long-term timber supply. It also includes concern for ensuring cost-effective timber harvest.

Issue 2: Fish Habitat and Water Quality

This issue addresses public concern for maintaining water quality in streams which provide suitable habitat for anadromous and resident fish. Fish and shellfish within the Chasina Project Area are important to sport, commercial, and subsistence users throughout Southeast Alaska.

Issue 3: Recreation and Scenic Quality

Forest management activities could affect existing recreational pursuits for users of the Chasina Project Area. More specifically, increased human access, timber harvest, and other developments could affect recreation values and opportunities including: hunting, fishing, scenic quality, and existing recreation facilities. Comments mentioned the importance of protecting the scenic quality along inlets and bays. Other aspects of this issue were related to conflicting uses in North Arm Moira.

Issue 4: Wildlife

This issue includes concerns over several wildlife species and the habitats critical to the maintenance of those wildlife populations; Alaskan wildlife is valuable for aesthetic, economic, recreational, ecological, and subsistence purposes. Of primary concern are the effects of timber harvest and associated road construction upon wildlife species dependent on old-growth habitat. There is also a concern regarding the proportion of Volume Classes 6 and 7 remaining after harvest in each management area. The long-term disposition of previously

mapped old-growth areas (commonly referred to as retention areas) in the project area was identified as part of this issue. Related to the overall concern is the question of whether timber harvest operations would further fragment existing large blocks of old-growth habitat and result in declines in biological diversity. The need for a project specific old-growth habitat strategy that ties into a larger scale habitat strategy was also identified.

Issue 5: Subsistence

Primary concern is the potential effect, as well as the cumulative effects, of timber harvest and road construction upon the abundance and distribution of subsistence resources. For many, subsistence consists of hunting, fishing, trapping, and gathering to supplement their food sources, income, and other needs. For Southeast Alaska's Natives, it is a way of life directly related to preserving their culture and traditions. The Alaska National Interest Lands Conservation Act (ANILCA) specifically requires the Forest Service to determine if the proposed activities may significantly restrict subsistence use. Other aspects to be evaluated are competition from non-rural subsistence users and access to the resources.

Issue 6: Caves and Karst

This issue reflects concerns about how the cave and karst resources in the project area will be managed and protected.

Issue 7: Social and Economic Effects

This issue reflects concerns about effects on community employment and income, population, community stability, and lifestyles. The economies of most communities in Southeast Alaska depend almost exclusively on the Tongass National Forest to provide natural resources for uses such as fishing, tourism, recreation, timber harvesting, mining, and subsistence. Many Southeast Alaskans want to maintain the natural environment which makes their lifestyle unique. At the same time, they want to continue maintaining their economic livelihood.

Issue 8: Marine Environment

The marine waters and their associated mud flats and estuaries found in protected coves and bays within the project area provide habitat for species such as Dungeness crab and juvenile salmon. Since coves and bays are the points of concentrated activity associated with marine transport of logs, logging camps, and sort yards, some marine species are subject to effects from log transfer and storage facilities. Three potential or existing LTF sites are under consideration in the alternatives.

Issues Outside the Scope of This Analysis

The following public issues were considered but eliminated from detailed study because their resolution is beyond the scope of this document.

Issue A: Land Use Designations/Forest Plan Revision

This issue focuses on the stated desire of some commenters to change TLMP Land Use Designations to eliminate, reduce, or increase the level of harvest and/or maximize specific resources.

Land use allocation is a Forest planning issue. The current Forest Plan is under revision and provides a forum for people who wish to see the area managed in a manner that differs from the current direction.

Issue B: Development Outside the Project Area

Comments regarding the general level of development outside the project area are not considered issues ripe for decision under the Chasina EIS. These areas include other National

Forest land on Prince of Wales Island, and Native lands. However, timber harvest that has occurred on Native lands will be included in the Cumulative Effects Analysis for the various resources.

Issue C: Below Cost Timber Sales

Below cost timber sales are a national issue and not within the scope of this project. The financial impacts of the alternatives, based on a mid-market analysis, are displayed in Chapter 3 in this EIS.

Issue D: Timber Supply and Demand

Timber supply and demand is a regional issue and exceeds the scope of this analysis. A site-specific environmental analysis documents the effects of the proposed activities; it does not constitute the selling or conveyance of property rights. The volume of timber cleared in any NEPA document may be offered (sold) in part, in whole, or not at all.

The timber offered for sale (timber offerings) may occur in one year or be spread over a three- to five-year period. Therefore, trying to predict the effects of the proposed activities upon the regional timber supply or demand is beyond the capability and scope of this document beyond concluding that timber offerings that implement the project will contribute volume to the timber supply and help meet demand.

The issue of how the project area contributes to the long-term timber supply is addressed as part of Issue 1: Timber Economics and Supply.

Issue E: Manage Chasina for Sustained Yield

The National Forest Management Act (NFMA) directs that a sustainable level of harvest be identified for each National Forest. A sustainable level of harvest is one in which the level of harvest is equal to or less than the rate of growth over a period of time (ten years in the case of NFMA). There is no direction or intent to establish a sustainable level of harvest for individual project areas or small geographic subdivisions of the Forest.

Federal and State Permits, Licenses, and Certifications

To proceed with the timber harvest as addressed in this EIS, various permits must be obtained from Federal and State agencies. Administrative actions on these permits would be initiated after the EIS is filed with the Environmental Protection Agency (EPA). The agencies and their responsibilities are listed below.

U.S. Army Corps of Engineers

- Approval of discharge of dredged or fill material into waters of the United States (Section 404 of the Clean Water Act of 1977, as amended).
- Approval of construction of structures or work in navigable waters of the United States (Section 10 of the Rivers and Harbors Act of 1899).

U.S. Environmental Protection Agency

- Storm water discharge permit.
- National Pollutant Discharge Elimination System review (Section 402 of the Clean Water Act).

State of Alaska, Department of Natural Resources

- Authorization for occupancy and use of tidelands and submerged lands.

State of Alaska, Department of Environmental Conservation

- Certification of compliance with Alaska Water Quality Standards (Section 401 Certification).
- Solid Waste Disposal Permit (Section 402 of the Clean Water Act).

U.S. Coast Guard

- Coast Guard Bridge Permit (in accordance with the General Bridge Act of 1946) required for all structures constructed across navigable waters of the U.S.

Legislation and Executive Orders Related to This EIS

Shown below is a brief list of laws pertaining to preparation of EISs on Federal lands. Some of these laws are specific to Alaska, while others pertain to all Federal lands.

- National Historic Preservation Act of 1966 (as amended)
- Wild and Scenic Rivers Act of 1968, amended 1986
- National Environmental Policy Act (NEPA) of 1969 (as amended)
- Clean Air Act of 1970 (as amended)
- Alaska Native Claims Settlement Act (ANCSA) of 1971
- Marine Mammal Protection Act of 1972
- Endangered Species Act (ESA) of 1973 (as amended)
- Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 (as amended)
- National Forest Management Act (NFMA) of 1976 (as amended)
- Clean Water Act of 1977 (as amended)
- American Indian Religious Freedom Act of 1978
- Alaska Native Interest Lands Conservation Act (ANILCA) of 1980
- Archeological Resource Protection Act of 1980

- Cave Resource Protection Act of 1988
- Tongass Timber Reform Act (TTRA) of 1990
- Executive Order 11988 (floodplains)
- Executive Order 11990 (wetlands)
- Executive Order 11593 (cultural)
- Executive Order 12962 (aquatic systems and recreational fisheries)
- Executive Order 12898 (environmental justice)

In addition, the Coastal Zone Management Act (CZMA) of 1976, as amended, pertains to the preparation of an EIS. Federal lands are not included in the definition of the coastal zone as prescribed in the CZMA. However, the act requires that when Federal agencies conduct activities or development that affect the Coastal Zone, that agency's activities or development be consistent to the maximum extent practicable with the approved State Coastal Management Program. This determination is made by the U.S. Forest Service.

The Alaska Coastal Management Plan incorporated the Alaska Forest Resources and Practices Act of 1979 as applied standards and guidelines for timber harvesting and processing. The Forest Service Standards and Guidelines and Mitigation Measures described in Chapter 2 of this document are equal to or exceed State Standards.

Availability of the Planning Record

An important consideration in preparation of this EIS has been reduction of paperwork as specified in 40 CFR 1500.4. In general, the objective is to furnish enough site-specific information to demonstrate a reasoned consideration of the environmental impacts of the alternatives and how these impacts can be mitigated.

The Planning Record is available upon issuance of the EIS at the Craig Ranger District office, Craig, Alaska. Other reference documents such as the Tongass Land Management Plan (TLMP, as amended 1979a), the Revised Supplement Draft Tongass Land Management Plan EIS (TLMP RSDEIS, 1996a), the Tongass Timber Reform Act, the Resources Planning Act, and the Alaska Regional Guide EIS, are available at public libraries around the region as well as at the Supervisor's Office in Ketchikan.

Chapter 2

Alternatives

Outline

Chapter 2

Alternatives

Key Terms

Alternative—one of several policies, plans, or projects proposed for decision making.
Best Management Practices (BMPs)—practices used for the protection of water quality.
Desired Future Condition—concise statement that describes a desired condition to be achieved sometime in the future. It is normally expressed in broad, general terms and is timeless in that it has no specific date by which it is to be completed.
FTE—Full Time Equivalent.
Large Old-Growth Blocks—contiguous blocks of wildlife habitat to be managed and conserved for breeding pairs, connectivity, and distribution of species of concern.
Implementation Monitoring—collecting information to evaluate whether mitigation measures were carried out in the manner called for.
Logging System Transportation Analysis (LSTA)—interdisciplinary design and mapping of all potential timber harvest units, including associated logging and transportation systems.
Mitigation—measures designed to counteract or lessen environmental impacts.
MMBF—a million board feet.
Partial Cut—a method of harvesting trees where any number of live trees are left standing in any of various spatial patterns; not clearcutting.
Roadless Area—an area of undeveloped public land identified by the TLMP RSDEIS (1996a) within which there are no improved roads maintained for travel by means of motorized vehicles intended for highway use.
Subsistence—the customary and traditional uses by rural Alaskan residents of wild renewable resources for direct personal or family consumption.
Windfirm—individual trees that are able to resist windthrow or the configuration of harvest units so as not to create an opening which exposes the adjacent stand of timber to the direction of the major prevailing storm wind (southeast).

Introduction

Chapter 2 summarizes the development of alternative actions for making timber available to the local forest products industry, while implementing the Tongass Land Management Plan (TLMP 1979a, as amended) in the Chasina Project Area. It also discusses the alternatives considered but eliminated from detailed study. Finally this chapter explains and compares the six alternative actions selected for detailed study. Chapter 2 is intended to present the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public (40 CFR 1502.14).

Much of the information in Chapter 2 is summarized from Chapter 3, Environment and Effects. Chapter 3 contains the detailed scientific basis for establishing a baseline and measuring the environmental consequences for each of the alternatives. For the best understanding of the six alternatives, readers should consult Chapter 3.

Changes Between NOI and DEIS

The Notice of Intent (NOI) for the Chasina Project included a map with the potential units and numbers displayed. Many of the units were field checked during the summer and fall of 1995 by fishery biologists, wildlife biologists, soil scientists, road engineers, landscape architects, geologists, silviculturists, and archaeologists. This resulted in some units being modified or dropped due to resource concerns, in regards to meeting Forest Standards and Guidelines. Some examples of this would be portions of a unit dropped for fish buffers on an uninventoried stream and areas with very high mass movement soils being deleted.

Alternative Development

Each action alternative presented in this EIS is a different response to the significant issues discussed in Chapter 1. For this EIS, five action alternatives were developed to meet the stated purpose and need of the project, while minimizing or avoiding environmental impacts. Each action alternative represents a site-specific proposal developed through intensive interdisciplinary unit and road design using high resolution topographic maps, GIS mapping capabilities, and aerial photos coupled with resource inventories and site inspections.

The alternative formulation process has been guided by several concepts and principals of sound resource management. Each alternative follows the standards, guidelines, and direction contained in the TLMP, the Alaska Regional Guide, and applicable Forest Service manuals and handbooks. Because of the possibility that the timber volume may be used to satisfy part of the contractual requirements of a long-term timber sale contract, they are also designed to meet the requirements of the Tongass Timber Reform Act (TTRA).

Ecosystem Management

Ecosystem management is a concept incorporated into forest management in recent years. The philosophy is to emphasize ecological, physical, and social sciences to guide resource management to sustain the health, productivity, and intangible values of the land. These concepts were considered in the selection and design of individual harvest units and roads included in the alternatives.

Ecosystem management looks at forest management on two levels: (1) the landscape level, which may be a geological province (geoprovince) or a large watershed; and (2) the stand level, which deals with individual harvest units. The forest plan incorporates ecosystem management at the **landscape level** through land use allocation and the development of standards and guidelines. This separates incompatible uses and spreads impacts out over time and space. Many issues—such as maintaining large unfragmented blocks of old growth over time and maintaining the connectivity between those blocks—can only be resolved over the entire rotation through the land use allocation or forest planning process. A site-specific project level plan evaluates the assumptions made in a higher level plan. It then implements that direction and responds to public comments through the development of alternatives which determine which stands are treated and how they are managed.

Some tools employed at the **stand level** may include:

- a deferred entry
- reducing harsh edges through unit placement, looking for opportunities to retain small patches of uncut timber in harvest units (where feasible and practical)
- maintaining existing travel corridors
- leaving snags in harvest units (where safety regulations allow)
- trying nonstandard harvest practices where resource issues and physical limitations permit.

The Chasina IDT utilized a combination of public scoping issues and resource knowledge to subdivide the Chasina Project Area into a variety of important landscape zones. Definition of these landscape zones considered such aspects as the amount, distribution, and fragmentation of old-growth forests; the level and distribution of previous timber harvest and roading; travel and dispersal corridors between zones that can be used by animals; the existing and potential road network for accessing timber; subsistence uses; visually sensitive areas; and important recreation areas. The landscape zones also considered the recommendations of the Viable Population (VPOP) Committee on such aspects as small, medium, and large Habitat Conservation Areas (HCAs). The landscape level considerations included the characteristics of the Chasina Project Area itself as well as its relationship to adjacent areas such as the harvest activities on Kootznoowoo, Inc. lands, the Polk Inlet Project Area, and wildlife habitat outside the project area. Consideration was given to social factors (including subsistence use, visual concerns, timber harvest economics, and proposed land use designations) in the development of landscape zones. Table 2-1 displays the Landscape Management Zones identified by the interdisciplinary team for the Chasina Project Area.

Table 2-1
Chasina Landscape Management Zones

Landscape Zones	Description
1. Large and Medium sized old-growth habitat blocks	Large and medium Habitat Conservation Areas (HCAs) as defined in the 1994 Draft Interim Habitat Management Guidelines EA. No final decision has been issued. The shape and configuration displayed represents one potential way of providing core areas of unfragmented old-growth habitat where significant populations of old-growth dependent species can be maintained.
1(A) Nutkwa Block	This large old-growth habitat block is comprised of the Nutkwa LUD II Area (timber harvest is not allowed) plus a portion of VCU 678 that connects to the estuary at the head of South Arm of Cholmondeley Sound. This block is approximately 38,300 acres in size and also contains the old-growth patches at the head of South Arm which are available for harvest under TLMP RSDEIS (1996a).
1(B) Kitkun Bay Block	This medium sized old-growth habitat block is located around Kitkun Bay or Salt Chuck. This block is approximately 10,400 acres in size. This block extends down to Port Johnson and North Arm Moira. This area contains the largest of unfragmented, high volume old-growth forest in the project area. When combined with the fact that it surrounds a salt chuck, this block is very important for wildlife habitat.
2. Late-successional Corridors	Corridors approximately one-quarter mile wide that provide connectivity between core areas of unfragmented old-growth habitat. These corridors generally follow riparian zones or other areas of gentle topographic relief commonly utilized for migration between areas.
3. Low and Very Low Economic Zones	These zones represent areas which are only economical to harvest during market cycles with very high stumpage when lumped together with more profitable offerings which could help average out costs, or if augmentation (contributed funds) helps to offset costs. Dora Bay Area VCU 677 - National Forest System lands in this area have become isolated and scattered as a result of land conveyances to Kootznoowoo, Inc. Estimated road costs to connect this area to existing roads on Kootznoowoo lands or to the Lancaster LTF are cost-prohibitive. Virtually all of the timber within this zone has been classified as unsuitable for timber harvest due to very high mass movement potential (MMI 4) soils, and what is not has small, isolated units with low volume per acre. Therefore, there is insufficient timber value to recover the road construction costs. Chasina Point Area VCU 679/680 - This area is characterized by relatively flat terrain with extensive areas of noncommercial forest. Much of the commercial forest land consists of narrow strips of low-volume old growth that is frequently located in stream buffers, making them unavailable for timber harvest. Due to the small amount of timber available, a large portion of the timber which is available would be harvested the first entry. The timber economics of the area are poor due to the low volume available per mile of road constructed. Since most of the timber in this area is Volume Class 4 and 5, harvesting units in this area could help alternatives meet proportionality. Several dispersed recreation sites are located in the area. Field crews did observe high wildlife use of the area. East Dolomi Area VCU 680/681 - This area is along Clarence Strait and is surrounded by lands owned and managed by Kootznoowoo, Inc. Most of the lands surrounding this area have been harvested within the last 10 years. This harvest decreased the effectiveness of the beach fringe as a

Table 2-1 (continued)
Chasina Landscape Management Zones

Landscape Zones	Description
	travel corridor for wildlife. The commercial lands in this area are mostly low volume, but are economically more feasible than the Chasina Point area. The Forest Service has retained an easement across Kootznoowoo, Inc. land to access this from the Lancaster area. Like Chasina Point, timber harvest in this area could help alternatives meet proportionality.
4. Lancaster VCU 679	This area includes the existing LTF and developed road system. Timber harvest in this zone is very profitable due to the concentration of high-volume, old-growth forest and the limited amount of road construction needed to access the timber. Part of the reason for the concentration of high volume old growth is that part of the area is underlaid with limestone which results in the development of well-drained, productive forests. Cave and karst features exist and current mitigation measures have been applied. The portion of this area adjacent to saltwater has been identified as an important wildlife corridor. Several dispersed recreation sites exist in the area, with hunting and trapping activities apparent. Field crews did observe high wildlife use in this area, especially by bear and wolf.
5. Port Johnson VCUs 681/682	This entire peninsula is currently in an undeveloped condition. Much of the coastal areas are steep with cliffs. The North Arm Moira shoreline has several good anchorages. The area contains a variety of dispersed, undeveloped recreation sites. It is also heavily used by the commercial fisheries fleet. A large percentage of the peninsula is noncommercial forest land, and most of the commercial forest land is low volume. The area between Port Johnson and Kitkun Bay is designated as a medium-sized HCA. A road constructed through the HCA to Port Johnson will have poor economics due to the low amount of timber accessed per mile of road construction. The land just north of the peninsula has been harvested and has an existing LTF on Kootznoowoo, Inc. land. It may be possible to conduct some helicopter logging on the north side of the peninsula while maintaining the visual, recreational, and wildlife values that exist on the south side along North Arm Moira. An LTF has been proposed in North Arm Moira, which is an option versus making a road connection to the Lancaster LTF. Another option is to helicopter harvest units in the area.
6. Cannery Creek VCUs 674/678	The Cannery Creek zone is another block of unfragmented, high volume, old-growth forest. This old-growth block is adjacent to a small HCA that was part of "Old-growth Retention Strategy A" for the Polk Inlet FEIS and is included in the small HCA as part of the "Old-growth Retention Strategy B". This is an important location for wildlife habitat due to the impacts that are occurring on other lands immediately adjacent to this area. To the east and south, old-growth forests on private lands are being or have been harvested. To the west, additional native harvesting is occurring in the Big Creek and Sulzer Portage areas. In order to harvest wood from the Cannery Creek, a new LTF and approximately 7 miles of road would need to be constructed; or all the timber would need to be helicoptered to a barge or "boom bags". The timber economics of this area are lower than roaded areas like Lancaster. Bands of karst features have been found between Cannery Creek and South Arm Cholmondeley Sound.

Chapter 3 and the Appendices contain additional maps that present some of the features described above in greater detail. The landscape zones described in the previous table (Table 2-1) are displayed by location in Figure 2-1.

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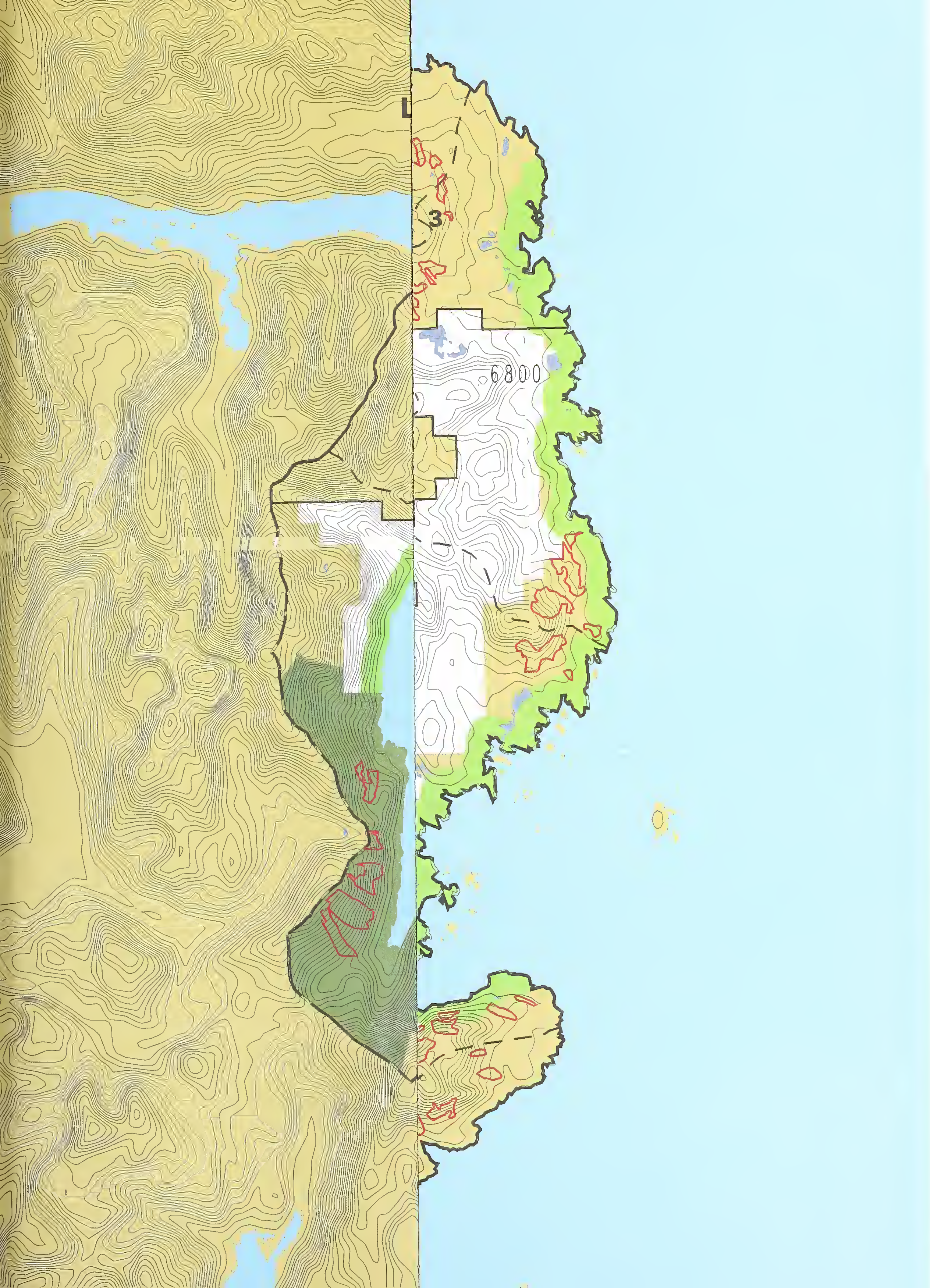

3
6800


Landscape Zones - Chasina Project
6740
6
6780
3
6770
6800
3
4
6790
6810
5
6820
Private & State Lands
Lands outside Large Medium or Small Old Growth blocks
Large and Medium Old growth Reserves
Travel Corridors
Saltwater
Contours
Unit Pool
VCU Lines
Project Boundary
Economic Zones
0
1.41
2.82 Miles
Mapscale 1:89274

Process Used to Formulate Alternatives

An interdisciplinary approach was used in developing alternatives for making timber available. The scoping process for the Chasina Project Area began in October 1995, and concluded in December 1995. Alternative formulation began after completion of the scoping process and was designed to address public issues, Forest Service concerns, and opportunities identified in scoping. The following general guidelines were used to formulate alternatives:

Address the Issues Identified During the Scoping and Public Comment Periods

This ensures that the interests of the various citizens, groups, and organizations that could be affected by this project are reflected in the array of alternatives.

Integrated Resource Analysis Focused on the Proposed Action

Forest Plan implementation begins with a comparison of the existing condition with the management emphasis for the area, and is followed by a determination of what, if any, changes are necessary. The purposes of integrated resource analysis are to determine possible combinations of management practices that are responsive to identified changes and to ensure that these combinations are consistent with Forest Plan direction.

Adherence to Forest Plan objectives and standards is an essential component of Forest Plan implementation [36 CFR 219.10(e);36 CFR 219.11(c)]. The Forest Plan standards establish limits on adverse environmental impacts and require that unless specified levels of mitigation can be achieved, a project or activity won't be proposed. Thus the list of possible management practices which would work toward the desired future condition for timber must be consistent with the need to meet Forest Plan standards and objectives for other resources.

Evaluate a Reasonable Range of Alternatives

The issues, the ways of addressing the issues, and possible levels of resource use on Prince of Wales Island vary widely. The interdisciplinary team concentrated on providing a range of alternatives by varying the location and mixes of resources committed under each alternative and by varying the number and kinds of activities to be conducted.

Section 102(2)(e) of NEPA states that all Federal agencies shall "*study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources*." These unresolved conflicts, identified by the Forest Service and the public, are the NEPA issues related to the proposed action.

In addition to responding to unresolved conflicts, an EIS must "*rigorously explore and objectively evaluate all reasonable alternatives*" [40 CFR 1502.14(a)]. The courts have established that this direction does not mean that every conceivable alternative must be considered, but that selection and discussion of alternatives must permit a reasoned choice and foster informed decision making and informed public participation.

Taken together, these requirements determine the NEPA range of alternatives.

Upper limits on timber outputs and associated road mileages considered in this EIS are imposed by Tongass Land Management Plan (TLMP 1979a, as amended) Standards and Guidelines for other resources as well as legal obligations on timber harvest set out in 36 CFR 219.27 and Section 6(g)(3)(e) of the National Forest Management Act.

Lower limits on timber outputs and associated road mileages are directly related to the issues and concerns, as well as the purpose and need for action described in Chapter 1.

Consistency with TLMP RSDEIS (1996a), Preferred Alternative Standards and Guidelines

This DEIS was developed consistent with the Standards and Guidelines in the Preferred Alternative of the TLMP RSDEIS (1996a) to the maximum extent practicable. The documented analysis and relevant discussion from this set of documents has been incorporated by reference rather than repeated (40 CFR 1502.21).

Follow an Interdisciplinary Process

This systematic, interdisciplinary approach ensures the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on the environment.

Alternatives Eliminated from Detailed Study

A number of alternatives were examined, but not considered, for detailed study in this draft environmental impact statement (DEIS). This section presents those alternatives and the rationale for not considering them further.

Alternative A

Single Resource or Issue

Alternatives that focused upon one resource or issue were eliminated from consideration as implementable alternatives. While alternatives constructed around a single resource may not be implementable, the issue itself may still be significant. Each alternative will be evaluated against all the significant issues.

Alternative B

Avoid Previously Mapped Old-growth Retention Areas

Several commenters asked the Forest Service to analyze an alternative that would keep intact all previously mapped old-growth retention during this entry. Under the 1996 TLMP RSDEIS Standards and Guidelines, old-growth habitat will remain unaltered in beach, estuary, and TTRA buffers, research natural areas, LUD I and LUD II areas, as well as in unsuitable commercial forest land. Previously mapped old-growth retention areas are consequently considered as part of the tentatively suitable and available timber base, unless otherwise excluded. Approximately 801 acres of retention were established as part of previous project level EISs, but no documents could be found which map these areas.

Current conservation biology theory places greater emphasis on larger blocks of old growth which have logical connections for wildlife movement. This alternative was, therefore, not considered in detail.

Alternative C

Manage the Chasina Project Area for Sustained Yield/Even Flow of Forest Products

Several commenters asked the Forest Service to display an alternative that displayed the real sustainable harvest level when taking into consideration such things as "falldown" and rotation lengths based on site index, not a 100-year rotation age. Although this alternative has not

been displayed, the components of this issue are analyzed in the Silviculture and Timber and Socio-Economic sections of Chapter 3 as cumulative impacts.

Alternative D

Several public and agency comments requested the Forest Service analyze a reduced harvest within the Chasina Project Area, or select the no-action alternative because of the extensive timber harvest that has occurred on other ownership within the project area. Because of the defined purpose and need of the project (provide wood to the Ketchikan Area timber sale program), the current range of alternatives is being analyzed. More information on why lower volumes were not considered is included in Appendix A.

Alternatives Considered for Detailed Study

Six alternatives for making timber available to local timber purchasers from the Chasina Project Area were considered in detail. Each alternative is consistent with the TLMP (1979a, as amended) and the Preferred Alternative of the TLMP RSDEIS (1996a). For each alternative this section provides a discussion of: (1) the emphasis or intent of the alternative, (2) various resource outputs associated with implementation, and (3) environmental consequences. Alternatives are compared in detail later in this chapter and summarized in Table 2-2.

Alternative 1 (No Action)

Emphasis

The emphasis of this alternative is to propose no new timber harvest from the Chasina Project Area at this time. It does not preclude timber harvest from other areas at this time, or from the Chasina Project Area at some time in the future. The Council of Environmental Quality (CEQ) regulations 40 CFR 1502.14d requires a "No-Action" alternative be analyzed in every EIS. This alternative serves as a benchmark by which effects of the other action alternatives are to be measured. The Existing Condition map shows the distribution of vegetation associated with no new timber harvest.

Outputs

There are no new timber harvest outputs associated with this alternative. Visual quality, wildlife habitat quality, recreation opportunities, as well as other resource values would remain at their current condition.

Alternative 2

Emphasis

The emphasis of this alternative is to meet the stated purpose and need while avoiding timber harvest in VCUs 674, 677, 678, and the Kitkun Bay area. These areas contain the largest blocks of high value wildlife habitat in the project area and deferral would avoid any fragmentation of them this entry. Individual unit selection attempted to avoid wildlife travel corridors. This alternative differs from Alternative 3 in that less volume is harvested and units were selected for harvest as to avoid areas identified during scoping as being important or special.

Outputs

Alternative 2 schedules the harvest of 33 individual harvest units, totaling 34.1 MMBF of sawlog plus utility volume from 1,160 acres, indicating an average unit size of 35.2 acres. Of

this harvest, 521 acres are planned for partial cut treatments; the remainder are planned for clearcut harvest. This alternative requires the construction of 12 miles of new specified roads plus 8 miles of reconstruction. Road construction clearing will yield an additional 2.8 MMBF of right-of-way (ROW) volume. This indicates an average of 2.8 MMBF per mile of new road construction. It schedules 129 acres or 9.8 MMBF of volume for helicopter yarding. Preliminary analysis indicates a net mid-market stumpage value of $-23.45 per MBF.

No new log transfer facilities (LTFs) would be required to implement this alternative. Floating or land based logging camps are anticipated with the Lancaster LTFs.

Alternative 3

Emphasis

The emphasis of this alternative is to meet the stated purpose while striking a balance between timber sale economics and other resource values. This alternative makes an entry into VCU 678, but leaves the Cannery Creek watershed intact. A road tie from Port Johnson Peninsula to the proposed LTF in North Arm Moira would occur under this alternative. Timber harvest would not occur in large old-growth blocks designated as HCAs in South Arm or the Kitkun Bay Area and would maintain the small HCA proposed in the Polk Inlet FEIS for Strategies A and B.

Outputs

Alternative 3 schedules the harvest of 56 individual harvest units, totaling 55 MMBF of sawlog plus utility volume from 1,900 acres, indicating an average unit size of 33.9 acres. Of this harvest, 345 acres are planned for partial cut treatments; the remainder are planned for clearcut harvest. This alternative requires the construction of 37 miles of new specified roads plus 11 miles of reconstruction. Road construction clearing will yield an additional 6 MMBF of right-of-way (ROW) volume. This indicates an average of 1.6 MMBF per mile of new road construction. It schedules 179 acres or 4.0 MMBF of volume for helicopter yarding. Preliminary analysis indicates a net mid-market stumpage value of $-53.90 per MBF.

The development of two new LTFs and the use of one existing LTF will be required to implement this alternative. Floating or land based logging camps are anticipated with the proposed North Arm Moira and West Arm Cholmondeley LTFs, and the existing Lancaster Cove LTF. The Alternative 3 map provides the spatial relationship among roads, units, and other geographic features of the Chasina Project Area.

Alternative 4

Emphasis

The emphasis of this alternative is to harvest the maximum amount of timber while keeping the amount of road construction to a minimum. This alternative looks at helicopter logging several portions of the project area and utilizing barge or small water drop areas (Cannery Creek and Port Johnson Peninsula) instead of constructing logging roads and LTFs. This alternative will display the trade-offs in economics and resource concerns between helicopter logging and conventional cable logging/road building.

Outputs

Implementation of this alternative would schedule the harvest of 2,891 acres in 74 harvest units for approximately 85 MMBF of sawlog and utility volume, indicating an average unit size of 39 acres. Of this harvest, 598 acres are planned for partial cut treatments; the remainder are planned for clearcut harvest. To implement this level of harvest, 19 miles of new road would be constructed, and 12 miles of existing road would require reconstruction. Road construction clearing will yield an additional 2 MMBF of right-of-way (ROW) volume.

This indicates an average of 4.5 MMBF per mile of new road construction. It schedules 1,290 acres or 35.2 MMBF of volume for helicopter yarding. Preliminary analysis indicates a net mid-market stumpage value of $-25.05 per MBF.

No new LTFs would be required to implement this alternative. Floating or land-based logging camps are anticipated with the Lancaster Cove LTF.

Alternative 5

Emphasis

The objective of this alternative is to emphasize timber economics and conventional cable yarding methods. The location of harvest units, selection of silvicultural prescriptions, logging systems, and a transportation network is primarily based on maximizing the mid-market value. This entry proposes only limited helicopter timber harvest. This approach emphasizes a positive net economic return for the proposed harvest units, by avoiding the low and very low economic zones to the extent possible to meet proportionality.

Outputs

Alternative 5 schedules the harvest of 64 individual harvest units, totaling 64.0 MMBF of sawlog and utility volume from 2,261 acres, indicating an average unit size of 35.3 acres. Of this harvest, 317 acres are planned for partial cut; the remainder are planned for clearcut harvest. This alternative requires the construction of 33 miles of new specified roads plus 12 miles of reconstruction. Road construction clearing will yield an additional 5 MMBF of right-of-way (ROW) volume. This indicates an average of 1.9 MMBF per mile of new road construction. It schedules 458 acres or 10.7 MMBF of volume for helicopter yarding. Preliminary analysis indicates a net mid-market stumpage value of $-37.08 per MBF.

The development of one new LTF and the use of one existing LTF will be required to implement this alternative. Floating or land based logging camps are anticipated with the West Arm Cholmondeley and Lancaster Cove LTFs. The Alternative 5 map provides the spatial relationship among roads, units, and other geographic features of the Chasina Project Area.

Alternative 6

Emphasis

The emphasis of this alternative is to accelerate progress toward the desired future condition for timber management while meeting Forest Plan Standards and Guidelines for other resources. Timber volume made available to local timber purchasers is maximized this entry under this alternative. This alternative is designed to evaluate the effects of harvesting as much of the project area as possible in a combination that still meets standards and guidelines. This alternative serves as an upper level benchmark that can be used to project the cumulative affects of the reasonably foreseeable future activities (see Appendix A) within the project area. Another feature of this alternative is that it looks at the maximum amount of road that could be constructed.

Outputs

Implementation of this alternative would schedule the harvest of 4,225 acres, in 124 harvest units for approximately 120 MMBF of sawlog and utility volume, indicating an average unit size of 34 acres. Of this harvest, 530 acres are planned for partial cut treatment; the remainder are planned for clearcut harvest. To implement this level of harvest, 63 miles of new road would be constructed, and 12 miles of existing road would require reconstruction. Road construction clearing will yield an additional 8 MMBF of right-of-way (ROW) volume. This indicates an average of 1.9 MMBF per mile of new road construction. It schedules 907 acres

or 23.4 MMBF of volume for helicopter yarding. Preliminary analysis indicates a net mid-market stumpage value of $-50.08 per MBF.

The development of one new LTF and the use of one existing LTF will be required to implement this alternative. Floating or land based logging camps are anticipated with the West Arm Cholmondeley and Lancaster Cove LTFs. The Alternative 6 map provides the spatial relationship among roads, units, and other geographic features of the Chasina Project Area.

Forest Service Preferred Alternative

Using an evaluative process that compares the benefits and adverse effects of each alternative against the issues, the USDA Forest Service has identified Alternative 3 as the Preferred Alternative for this EIS. The identified Preferred Alternative will be examined before preparation of a Final EIS, taking into consideration public comments received, as well as additional information and analysis.

Comparison of Alternatives

The comparison of alternatives draws together the conclusions from the analysis presented throughout the document and provides a summary of the results. Table 2-2 provides a summary of activities, outputs, and environmental consequences by which the alternatives may be compared. The following sections provide a comparison of alternatives by: (1) summary comparison of outputs and environmental consequences, (2) proposed activity, and (3) significant issues.

Summary Comparison

Table 2-2 provides a summary of activities, outputs, and environmental consequences by which the alternatives may be compared.

Table 2-2
Summary Comparison of Alternatives

Activity/Resource	Units	1	2	3	4	5	6
		Alternatives					
Timber							
Units	Number	0	33	56	74	64	124
Estimated harvest unit volume	MMBF	0	34	55	85	64	120
Estimated right-of-way (ROW) volume	MMBF	0	1	6	2	5	8
Uneven-aged partial cuts (diameter limits, group selections)	Acres	0	527	345	598	317	530
Clearcut harvest	Acres	0	633	1,555	2,293	1,944	3,695
Total harvest	Acres	0	1,160	1,900	2,891	2,261	4,225
Units over 100 acres	Number	0	1	1	2	0	2
Shovel harvest	MMBF	0	0	.8	0	0	.8
Running Skyline	MMBF	0	21.6	39.8	39.9	44.1	74.2
Live Skyline (Shotgun)	MMBF	0	1.2	4.3	5.3	5.3	9.8
Slackline harvest	MMBF	0	1.5	6.1	4.0	3.0	10.7
Helicopter harvest	MMBF	0	9.8	4.0	35.2	10.7	23.7
Estimated stumpage (mid-market rates)	$ / MBF	0	-23.45	-53.95	-25.05	-37.08	-50.08
Estimated stumpage (current rates)	$ / MBF	0	+154.31	+123.86	+152.34	+140.68	+127.00
Receipts to State of Alaska	$M	0	566	1,879	1,179	1,588	3,001
Average annual jobs over 4 years	# of jobs	0	51	86	124	98	183
Roads and Transportation							
Specified road construction	Miles	0	12	37.2	19.4	33.1	63.1
Road reconstruction	Miles	0	7.7	10.7	11.6	11.6	11.6
Temporary road construction	Miles	0	2.4	6.5	4.5	6.2	12.1
New log transfer facilities (LTFs)	Each	0	0	2	0	1	1
Reconstruction/Use of existing LTFs	Each	0	1	1	1	1	1
Roads crossing Class I or II streams	Number	0	12	35	10	24	43
Biodiversity							
Unfragmented old-growth patches remaining							
1,000 acres and larger	Acres	14,215	13,647	13,114	8,698	9,925	8,516
500-1,000 acres	Acres	4,019	2,871	2,834	5,091	5,844	3,858
100-500 acres	Acres	3,548	3,929	3,442	4,672	3,198	4,759
Nutkwa old-growth habitat - large block	Acres Harvested	0	0	0	146	146	252
Kitkun Bay old-growth habitat - medium block	Acres Harvested	0	0	0	704	574	856
Corridors connecting old-growth blocks	Affected	N/A	No	Yes	Yes	Yes	Yes
Productive old-growth acres remaining in project area	Acres	24,178	23,018	22,278	21,287	21,917	19,953
Percent of existing old growth remaining	Percent	100	95	92	88	91	83
Wildlife - Project Area							
1998 MIS - deer	Habitat Capability	2,017	1,924	1,879	1,807	1,843	1,713
1998 MIS - bear	Habitat Capability	77	75	73	71	72	69
1998 MIS - marten	Habitat Capability	86	82	80	77	79	73
1998 MIS - river otter	Habitat Capability	52	52	52	52	52	51
1998 MIS - hairy woodpecker	Habitat Capability	890	855	841	800	818	763
1998 MIS - Vancouver Canada goose	Habitat Capability	222	216	210	204	208	197
1998 MIS - bald eagle	Habitat Capability	121	121	121	121	121	120
1998 MIS - brown creeper	Habitat Capability	1,947	1,876	1,855	1,754	1,782	1,675
1998 MIS - gray wolf	Habitat Capability	5.8	5.5	5.4	5.2	5.3	4.9

Table 2-2 (continued)
Summary Comparison of Alternatives

Activity/Resource	Units	Alternatives 1	2	3	4	5	6
Subsistence - WAAs 1210, 1211, and 1213							
High and Moderate use subsistence (TRUCS)	Acres Harvested	0	0	0	0	0	0
Deer habitat capability	Habitat Capability	5,984	5,891	5,846	5,774	5,810	5,680
Deer population needed to support current harvest	Habitat Capability	800	800	800	800	800	800
Significant Possibility of a Significant Restriction							
Deer	Response	No	No	No	No	No	No
Bear	Response	No	No	No	No	No	No
Furbearers	Response	Yes	Yes	Yes	Yes	Yes	Yes
Salmon	Response	No	No	No	No	No	No
Other Finfish	Response	No	No	No	No	No	No
Waterfowl	Response	No	No	No	No	No	No
Marine Mammals	Response	No	No	No	No	No	No
Indirect and cumulative effects of implementing the Forest Plan over the entire rotation	Response	May	May	May	May	May	May
Cultural Resources							
Impacts to known cultural resources	Each	0	0	0	0	0	0
Floodplains and Wetlands							
Proposed harvest on floodplain soils	Acres	0	16	17	3	7	27
Proposed roading on floodplain soils	Acres	0	0	0	0	0	0
Proposed harvest on vegetated wetlands	Acres	0	324	796	760	865	1278
Proposed roading on vegetated wetlands	Acres	0	69	231	88	205	334
Soils							
Proposed harvest on very high MMI soils	Acres	0	5	32	39	3	56
Proposed roading on very high MMI soils	Acres	0	0	4	1	2	5
Proposed harvest on high MMI soils	Acres	0	179	418	789	716	1261
Proposed roading on high MMI soils	Acres	0	21	92	60	115	181
Proposed harvest on moderate MMI soils	Acres	0	366	756	1123	724	1522
Proposed roading on moderate MMI soils	Acres	0	73	201	160	173	343
Proposed harvest on low MMI soils	Acres	0	480	556	456	446	827
Proposed roading on low MMI soils	Acres	0	93	123	101	125	183
Projected soil disturbance by harvest	Acres	0	104	173	233	182	333
Projected soil disturbance by roads	Acres	0	117	362	230	338	650
Harvest on High Karst Vulnerability	Acres	0	0	0	0	0	0
Harvest on Medium Karst Vulnerability	Acres	0	101	158	400	198	413
Visual Quality							
Meets or Exceeds Proposed Visual Quality Objectives							
West Arm Cholmondeley Sound	Response	Exceeds	Exceeds	Exceeds	Meets	Meets	Meets
Sunny Cove	Response	Exceeds	Exceeds	Meets	Meets	Meets	Meets
Lancaster Cove	Response	Exceeds	Exceeds	Meets	Meets	Meets	Meets
Kitkun Bay	Response	Exceeds	Exceeds	Exceeds	Meets	Meets	Meets
Port Johnson	Response	Exceeds	Meets	Meets	Meets	Exceeds	Meets
Moria Sound	Response	Exceeds	Exceeds	Meets	Meets	Meets	Meets
North Arm	Response	Exceeds	Exceeds	Exceeds	Meets	Exceeds	Meets
Recreation							
Change in ROS class from P & SPNM to RM	Percent	0	4	30	35	34	61
Roadless areas	Acres	36,290	30,905	20,920	19,554	23,857	13,157
Recreation sites with change in ROS	Number	0	1	9	2	6	8

Comparison of Alternatives by Proposed Activity

The action alternatives propose the harvest of from 33 to 124 individual units. Alternative 6 proposes the highest level of harvest with approximately 4,225 acres of timber harvest. Of the action alternatives, Alternative 2 proposes the lowest level of harvest with 1,160 acres. Table 2-3 shows the number of acres proposed for harvest by each alternative by silvicultural system.

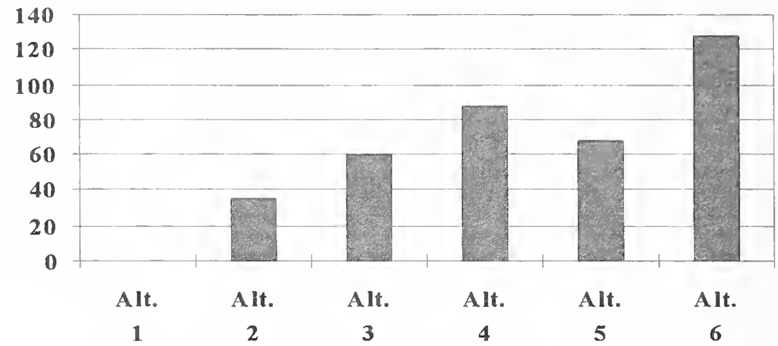
Table 2-3
Total Acres Proposed for Harvest by Silvicultural System

Silvicultural System	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Partial Cut	0	527	345	598	317	530
Clearcut	0	633	1,555	2,293	1,944	3,695
Total	**0**	**1,160**	**1,900**	**2,891**	**2,261**	**4,225**

Uneven-aged management (partial cuts) planned in the alternatives ranges from 317 acres in Alternative 5 to 598 acres in Alternative 4.

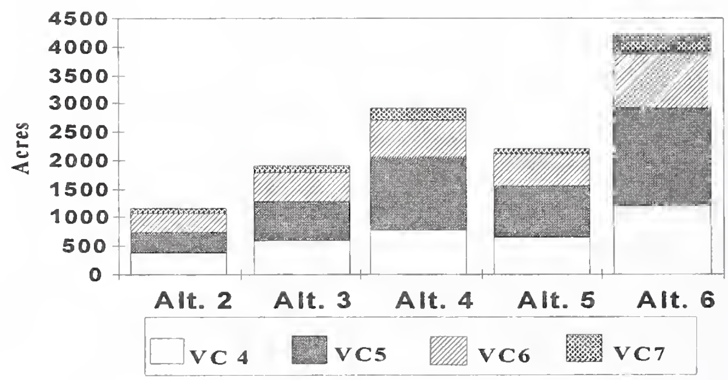
Excluding right-of-way (ROW) volume each action alternative, except Alternative 2, generated more volume than the identified purpose and need of 40 MMBF. Figure 2-2 shows the volume of timber proposed for harvest by each alternative.

Figure 2-2
Total Volume Proposed for Harvest Including ROW volume, in MMBF



Commercial forest land (CFL) is divided into Volume Class Strata according to the Ketchikan Area's timber type map. This volume class information is used in calculating volume harvested and economic analysis. Figure 2-3 shows volume class strata breakdown for each alternative. Inclusions of stands typed as non-commercial forest that were field verified to be merchantable were aggregated into the Volume Class 4 acres.

Figure 2-3
Proposed Harvest by Volume Class Strata



Road development is divided into two main categories—construction and reconstruction. Table 2-4 shows the number of miles of new road construction and reconstruction proposed to access the harvest units for each alternative.

Table 2-4
Proposed New Road Construction & Reconstruction (in Miles)

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
New Road Construction	0	12.0	37.2	19.4	33.1	63.1
Road Construction	0	7.7	10.7	11.6	11.6	11.6

There is one existing LTF and two new LTFs required to implement the various alternatives. Alternative 3 would utilize all three LTFs (Lancaster Cove, West Arm Cholmondeley, and North Arm Moira). This analysis has roughly estimated which units or groups of harvest units would most economically be hauled to a given LTF. Actual haul may be different. Table 2-5 shows the volume of harvest projected to be hauled to each LTF.

Table 2-5
Proposed Harvest, by Existing & New Log Transfer Facility, in MMBF

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Lancaster Cove	0	34.1	31.5	64.5	55.3	108.8
North Arm Moira*	0	0	11.6	0	0	0
West Arm Cholmondeley*	0	0	10.7	0	10.7	10.7

SOURCE: USDA Forest Service

* New Log Transfer Facilities

Comparison of Alternatives by Significant Issue

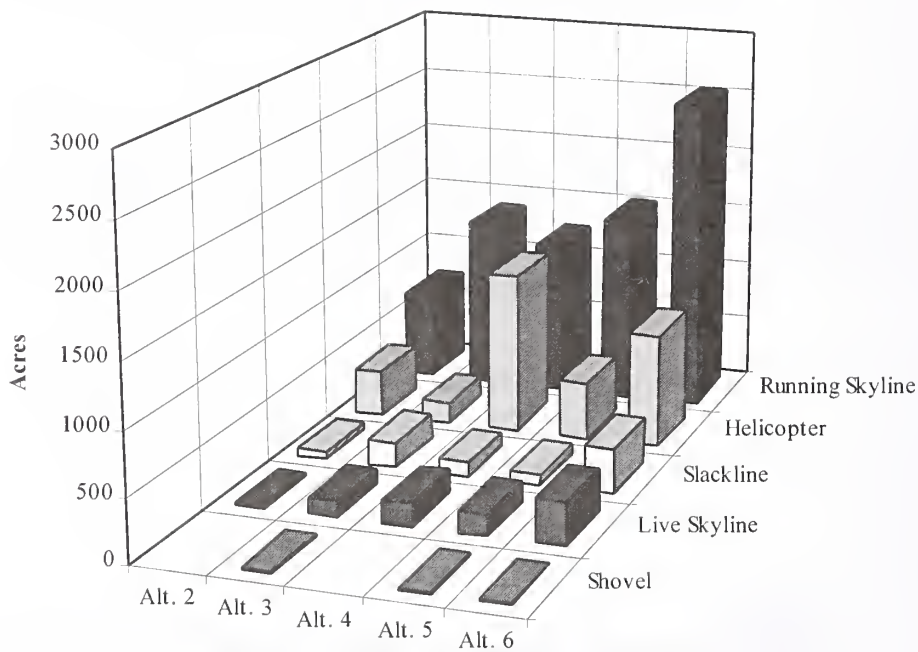
Chapter 1 presents in detail the significant issues that are the focus of this EIS and the key indicators for evaluating the impacts of timber harvest on each issue. This section compares the alternatives in terms of these issues. The baseline for comparing alternatives is Alternative 1, the no-action alternative. Chapter 3 contains the detailed evaluation of the potential effects of timber harvest and road construction activities under each alternative on forest resources.

Issue 1. Timber Harvest Economics

Logging Systems

Estimated timber economics focuses on the residual value (stumpage) of the timber after all associated logging and transportation costs are subtracted. Generally, the most expensive logging method is helicopter, followed by slackline, highlead, live skyline (shotgun), running skyline, and shovel yarding. Average yarding distance, uphill versus downhill yarding, volume per acre, species composition and value, in combination with other factors, will influence the relative cost of each yarding method. Helicopter yarding is necessary in areas where it is impractical to build road or where aerial logging is necessary to meet specific standards and guidelines. Alternative 4 proposes the most helicopter volume (35 MMBF), while Alternative 3 proposes very little (4 MMBF). Figure 2-4 compares the logging systems proposed for each alternative.

Figure 2-4
Timber Harvest by Logging System



Mid-market Value

The analysis of timber values in the Timber section of Chapter 3 looked at both the mid-market and current-market values for each alternative. The current-market values are considerably higher than the average or mid-market values which indicate that: (1) consumer demand is higher, (2) timber supplies are limited, or (3) some combination of the above is true.

All of the alternatives show a positive net stumpage at current-market values, while none of the alternatives are positive at mid-market value.

Table 2-6 compares the economics of timber harvest in dollars/thousand board feet ($/MBF) for each alternative under mid-market conditions (generally representing the average market condition and product mix) and current-market conditions. The conversion rate expresses the net dollar value of the timber volume after subtracting the production costs from the log values.

Table 2-6
Estimated Mid-market and Current-market Stumpage Value

	Alternatives					
Components	**1**	**2**	**3**	**4**	**5**	**6**
Mid-market Conversion Rate ($/MBF)	0	$-23.45	$-53.90	$-25.00	$-37.08	$-50.08
Current-market Conversion Rate ($/MBF)	0	+$154.31	$+123.86	$+152.34	$+140.68	$+127.00

SOURCE: USDA Forest Service

Issue 2. Fish Habitat and Water Quality

Best Management Practices

There is no measurable effect on water quality or fisheries production by any of the timber harvest or associated activities proposed by any of the action alternatives. All alternatives meet the requirements and intent of the Clean Water Act. Implementation of the TTRAs requirement to provide a minimum 100-foot buffer on Class I streams and Class II streams flowing directly into Class I streams would effectively mitigate direct stream channel impacts from proposed timber harvest and road construction. Adherence to BMPs outlined in the Soil and Water Conservation Handbook (USDA FSH 2509.22) during the design of units and roads will minimize the potential direct effects to fish as well. Site-specific BMPs were developed and selected to minimize the potential for impact to fish habitat. These site-specific BMPs are noted on the individual Harvest Unit and Road Design cards in Appendix J.

Habitat Capability

Fish habitat capability models are used to estimate the effects of timber harvest on the capability of streams to provide habitat for selected species of salmon and trout. Because there are many factors which influence fish populations—including commercial/sport harvest, oceanic conditions, and predation—these computer models provide only relative measures of habitat capability. These models indicate that there is no change in habitat capabilities for coho and pink salmon, or for Dolly Varden char and the species which they represent, among the alternatives including the no-action alternative.

TLMP RSDEIS 1996a, Preferred Alternative

The majority of watersheds (VCUs) within the project area have experienced prior roading and road construction. Reentering these drainages may generate a greater potential risk for impacts on water quality, with the risk expected to be greater in those watersheds with the higher cumulative percents of harvest. The standards and guidelines associated with Alternative P of the TLMP Draft Revision (1991a) limit the amount of timber harvest within a given watershed to 35 percent of the total land base within a 15-year period, although this has been dropped from the current TLMP RSDEIS (1996a). Table 2-7 shows the existing direct and indirect effects of timber harvest on third-order watersheds and important second-order watersheds.

Table 2-7
Cumulative Watershed Effects, Percentage of Watershed Harvested in Third Order or Larger Watersheds and Important Second-order Watersheds

Watershed Number	% Watershed Harvested 1982-1997					
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Third Order Watersheds						
E92A	26	26	26	28	26	32
E94A	58	70	70	58	64	70
H06A	0	0	0	0	0	0
H21A	0	0	<1	1	7	8
H27A*	61	61	61	61	61	63
H28A	8	8	8	8	8	9
H30A*	0	0	0	3	3	3
H38A*	48	48	48	48	48	48
H54A*	53	54	54	54	54	54
H62A	13	26	29	33	29	33
H63A	39	48	48	56	48	56
Second Order Watersheds						
H05A	1	1	1	2	2	2
H49A	1	1	1	13	4	18
H50A	15	15	15	18	18	18
H59A	8	25	15	24	21	26

SOURCE: USDA Forest Service 1996

* Includes Kootznoowoo, Inc. lands that have been harvested since 1982.

Stream Crossings

Another measure of potential risk to fish habitat from timber harvest is the associated new road construction and road reconstruction which crosses streamcourses (see Chapter 3-Aquatic Resources). During placement of culverts or bridges, sediment may be introduced into the streams which may have short- or long-term effects on water quality. Alternative 2 proposes the fewest stream crossings, while Alternative 6 proposes the most. This is shown in Table 2-8.

Table 2-8
Stream Crossings to be Constructed

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Class I	0	10	17	5	12	24
Class II	0	2	18	5	12	19
Class III	0	19	72	36	74	108
Total Crossing	**0**	**27**	**107**	**46**	**98**	**151**

SOURCE: USDA Forest Service 1996

Mass Movement Index (MMI)

Following timber harvest, there is an increased risk of landslides until second growth and the brush layer become firmly established. One way of analyzing this risk is to determine the amount of timber harvest on slopes which have high mass movement index (MMI) soils. This rating does not imply that such a mass-wasting event will occur; rather, it ranks the alternatives on the basis of the potential for a mass-wasting event to occur, which may or may not result in an increase in stream sediment. This increased stream sedimentation may result in some loss or impairment of resident and anadromous fish spawning and rearing habitat. Table 2-9 displays the proposed harvest on high MMI (MMI = 3) and very high MMI (MMI = 4) soils by alternative. Virtually all very high MMI soils have been removed from the base. Only those sites that appear to be small inclusions or mistyped have been retained in the unit pool. These sites have been examined by a soil scientist as part of unit reconnaissance.

Table 2-9
Acres of High Hazard Soils Harvested by Alternative

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
High MMI Soils	0	179	418	789	716	1261
Very High MMI Soils*	0	5	32	39	3	56

SOURCE: USDA Forest Service

* See Chapter 3-Soils for details of MMI classifications.

Sediment Transfer and Deposition

Three separate watersheds were evaluated for sediment delivery and depositional potential using a watershed-level analysis (Geier and Loggy, 1995). Sediment transport and deposition indices were developed based upon watershed morphology, discharge, and potential sediment sources. This sediment transfer index indicates where in a watershed sediment production and deposition is a potential problem for maintenance of aquatic habitat. The quantity of sediment transported and deposited depends upon a number of factors, including the nature of the sediment source, stream discharge, and channel morphology. These are factors that resource managers must consider when they undertake activities on areas that are linked to important aquatic habitat.

Results of this sediment transport and deposition risk assessment for roads and units indicate that alternatives that include Units 679-507, 679-425, and 679-422 have the highest potential for sediment delivery to streams. By avoiding harvest units and road construction near streamcourses in high risk sub-basins, Alternative 2 presents the lowest overall risk of sediment production and delivery to sensitive stream reaches. Alternative 6 presents a higher risk of producing sediment that may affect beneficial uses, mainly by proposing road construction and timber harvest in watersheds already heavily harvested. Alternative 6 poses the highest risk of sediment delivery.

Issue 3. Recreation and Scenic Quality

Scenic Quality

There are 3 key viewsheds within the project area. The proposed visual quality objectives (VQOs) for this project establish the minimum visual quality management standards for these key viewsheds.

Table 2-10 displays the proposed VQOs for each key viewshed and the percent change in visual cumulative disturbance level by alternative. Alternative 1 represents the existing visual condition. In all viewsheds for all alternatives, the proposed harvest units achieve the proposed visual quality objectives.

Table 2-10
Proposed VQOs and Changes in Cumulative Visual Disturbance

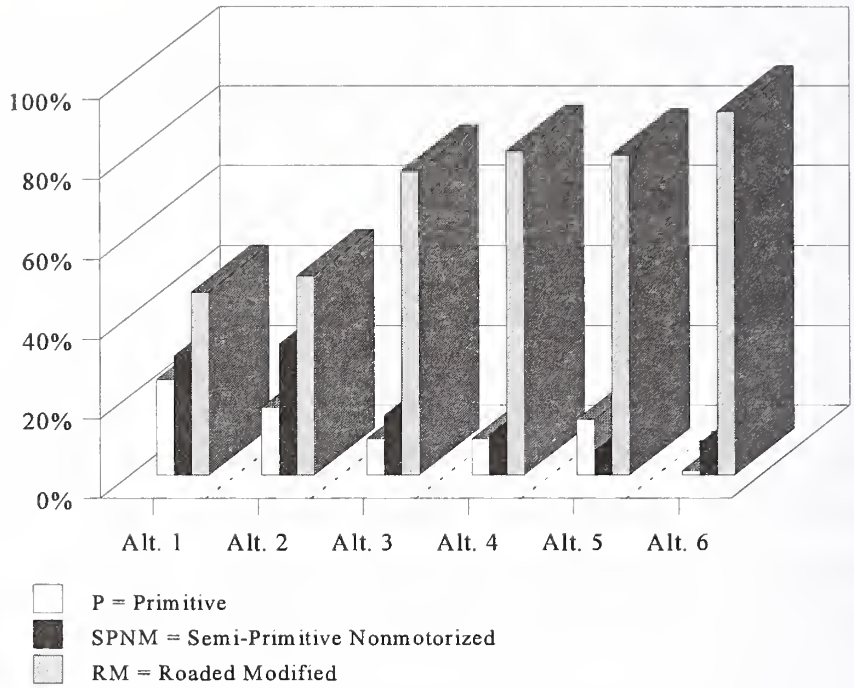
	Proposed VQO	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
W. Arm Chol. Sound	Par. Ret./Mod.	Exceeds	Exceeds	Exceeds	Meets*	Meets*	Meets*
Sunny Cove	Par. Ret./Mod./ Max. Mod.	Exceeds	Exceeds	Meets	Meets	Meets	Meets
Lancaster Cove	Max. Mod.	Exceeds	Exceeds	Meets	Meets	Meets	Meets
Kitkun Bay	Max. Mod.	Exceeds	Exceeds	Exceeds*	Meets	Meets	Meets
Port Johnson	Max. Mod.	Exceeds	Meets	Meets	Meets	Exceeds	Meets
Moira Sound	Par. Ret./Mod.	Exceeds	Exceeds	Meets*	Meets*	Meets*	Meets*
North Arm	Par. Ret./Mod.	Exceeds	Exceeds	Exceeds*	Meets*	Exceeds*	Meets*

Exceeds	Proposed harvest results in a visual condition that exceeds the proposed VQO for the viewshed, i.e. meets a higher VQO.
Exceeds*	Though the proposed harvest will meet the VQO in a portion of the viewshed, in the vast majority of the viewshed, the proposed harvest exceeds the VQO.
Meets	Harvest planned in the viewshed meets the proposed VQO.
Meets*	Harvest meets proposed VQO assuming mitigation measures are followed.

Recreation Opportunity Spectrum (ROS)

Implementing any of the action alternatives will change the existing Recreation Opportunity Spectrum (ROS) class within the project area. Figure 2-5 shows the change in ROS class by alternative.

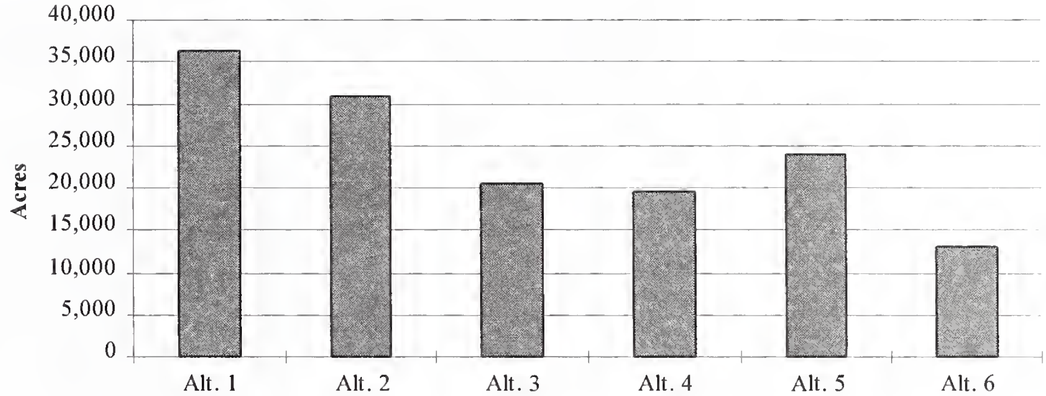
Figure 2-5
Changes in ROS Class by Alternative



Roadless Areas

The TLMP RSDEIS (1996a) identified one roadless area which lies within the project area. The impact of timber harvesting on roadless areas is much larger than the acres harvested because the sights and sounds associated with the harvest activity affect the surrounding area. Roadless areas generally need to be at least 5,000 acres in size to be considered roadless. Figure 2-6 shows the number of roadless acres that will remain after implementation of an alternative.

Figure 2-6
Roadless Area Acres Remaining by Alternative



Issue 4. Wildlife Habitat

The major effect on wildlife habitats in all action alternatives is the reduction of old-growth forest habitat. Impacts to other habitats were reduced by the interdisciplinary design of units prior to alternative formulation. All alternatives result in impacts consistent with the implementation of the TLMP (1979a, as amended) and the Preferred Alternative, TLMP RSDEIS 1996a, Standards and Guidelines.

Table 2-11 displays the potential reduction in wildlife habitat capabilities, as estimated by habitat capability models, for the key Management Indicator Species (MIS) found in the Chasina Project Area. This table displays the 1954 long-term habitat capability and estimated short-term reduction in habitat capability after potential implementation of the alternatives.

Table 2-11
Potential Changes in Habitat Capability Numbers Within the Project Area for MIS in 1998

	Habitat Capability		Changes from 1996 by Alternative					
Species	1954	1996	1	2	3	4	5	6
Sitka black-tailed deer	2,410	2,017	0	-93	-138	-210	-174	-304
black bear	86	77	0	-2	-4	-6	-5	-8
otter	52	52	0	0	0	0	0	-1
marten	97	86	0	-4	-6	-9	-7	-13
hairy woodpecker	900	890	0	-35	-49	-90	-72	-127
Vancouver Canada goose	242	222	0	-6	-12	-18	-14	-25
bald eagle	123	121	0	0	0	0	0	-1
brown creeper	1,983	1,947	0	-71	-92	-193	-165	-272
gray wolf	7	5.8	0	-0.3	-0.4	-0.6	-0.5	-0.9

SOURCE: USDA Forest Service, 1996

Note: Number do not incorporate patch-size effectiveness calculations (see the Old-Growth/Biodiversity section).

Forest fragmentation represents a change in the overall forest landscape from large, contiguous blocks of old-growth forest to smaller blocks separated by timber harvest units. Increased amounts of forest fragmentation indicate reduced habitat potential for species which are thought to be dependent on interior old-growth forest habitat. One way to analyze forest fragmentation is to measure the reduction of large, contiguous blocks of old-growth forest as a result of timber harvest. Large and medium sized blocks of old growth (Nutkwa LUD II Area and South Prince of Wales Wilderness Area) are adjacent to the project area. In addition, the project area contains a significant amount of old-growth habitat in blocks over 1,000 acres in size. Table 2-12 displays the number of acres of old-growth habitat in large blocks that will remain after implementation of an alternative.

Table 2-12
Effect of Timber Harvest on Forest Fragmentation in Acres

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Acres of unfragmented blocks of 101-500 acres remaining after harvest	3,548	3,929	3,442	4,672	3,198	4,759
Acres of unfragmented blocks of 500-1,000 acres remaining after harvest	4,019	2,871	2,834	5,091	5,844	3,858
Acres of unfragmented blocks of >1,000 acres remaining after harvest	14,215	13,647	13,114	8,698	9,925	8,516
Total acres of old growth remaining after harvest	24,006	22,814	22,084	21,101	21,718	19,830

SOURCE: USDA Forest Service 1996

Note: Old growth includes only Volume Class 4 and above.

Late successional corridors approximately one-quarter mile wide (see Figure 2-1) that provide connectivity between core areas of unfragmented old-growth habitat were identified. These corridors are along the west side of South Arm of Cholmondeley Sound and from Kitkun Bay to Chasina Point. Alternative 6 would impact the corridors to the largest degree, followed by Alternative 5, Alternative 4, and Alternative 3. Alternative 2 would do the best job of maintaining these corridors.

Issue 5. Subsistence Use

Chapter 3 evaluates the potential site-specific effects on subsistence that could result from implementing any of the proposed timber harvest and associated road construction alternatives.

The Tongass Resource Use Cooperative Survey (TRUCS) identified areas which are most heavily used by subsistence households. Based on the TRUCS, the project area contains no

high or moderate use subsistence areas. High and moderate use is interpreted to mean greater than 50 households ever used the area for subsistence deer hunting.

Deer hunting is one aspect of subsistence use affected by timber harvest. The Wildlife and Subsistence sections of Chapter 3 discuss the computer models used to estimate the effects of timber harvest on deer habitat capability—both long range and short range. Based on this analysis, Alternative 1 will cause no reduction of deer habitat capability. Among the action alternatives, Alternative 2 would cause the least reduction to deer habitat capabilities (93 deer), while Alternative 6 would reduce deer habitat capabilities the most severely (304 deer) within the project area.

Table 2-13 displays the number of deer the habitat in the WAAs (1210, 1211, and 1213) can support after the implementation of an alternative, and after the second growth is in a closed canopy (2040). The full WAA habitat capability has not been reduced for the effects of fragmentation.

Table 2-13
Deer Harvest and Habitat Capability for WAAs 1210, 1211, and 1213

Alternative	Habitat Capability		Population of Deer Needed to Meet Demand
	1998	2040	1996
1	5,984	5,984	800
2	5,891	5,809	800
3	5,846	5,725	800
4	5,774	5,590	800
5	5,810	5,658	800
6	5,680	5,414	800

SOURCE: USDA Forest Service 1996

Note: Habitat capability for entire WAAs has not been reduced for fragmentation

The project area is located within portions of three Wildlife Analysis Areas (WAA)—1210, 1211, and 1213. The harvest is 80 deer per year based on Alaska Department of Fish and Game (ADF&G) hunter surveys for the complete WAAs. Approximately 800 deer are needed to support this level of deer harvest. Currently (1996) the three full WAAs provide habitat capability for 5,984 deer. The habitat capability through the year 2004 is projected to be at least 5,680 deer.

Competition for subsistence resources in the project area is a scoping issue. Subsistence users from communities on Prince of Wales Island are concerned with competition from residents of

Ketchikan. Since Ketchikan residents are considered non-rural, this competition can be regulated if it starts to restrict rural residents' ability to obtain subsistence resources. Deer habitat capability in all WAAs is presently adequate to sustain all current and projected harvest now and through the year 2040.

The Federal Subsistence Board may use its authority to regulate non-rural harvest of deer and has authority to prioritize the harvest of deer among rural residents when necessary to protect the resource. The current deer population level does not require restrictions on non-rural users.

There is no evidence to indicate that availability of salmon, finfish, shellfish, or other food resources to subsistence users would be affected by sport or non-rural harvest. Any increase in competition from non-rural Alaskan residents and nonresidents would not be substantial because of the availability of resources in the immediate vicinity and in the surrounding areas.

The above analysis indicates that the actions proposed in all alternatives will not represent a significant possibility of a significant restriction on subsistence use of deer, black bear, or otter in the project area. Wolf harvest in the project WAAs is at the peak of the level that can be sustained. With future reductions of habitat capability for wolf and marten, there may be a significant possibility of a significant restriction of subsistence use of marten and wolf at some point in the future for all alternatives including the No-Action Alternative.

Issue 6. Caves and Karst

All alternatives were designed to maintain the natural karst processes and the productivity of the karst landscape. No harvest units are planned on high karst vulnerability areas. Table 2-14 displays the acres of harvest on high and medium karst vulnerability areas.

Table 2-14
Acres of Harvest on High and Medium Karst Vulnerability Areas

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
High Karst Vulnerability	0	0	0	0	0	0
Medium Karst Vulnerability	0	101	158	400	198	413

Issue 7. Social and Economic Effects

The State of Alaska receives 25 percent of the sum of all net receipts from timber sold on National Forest System lands plus any purchaser road credits. This money is earmarked for public school and road maintenance funding. Table 2-15 shows the estimated returns to the State of Alaska from the harvest of timber (from this project only) by alternative. Actual returns will be based upon sale volumes and appraised rates and may differ from this estimate, which is based on mid-market rates.

Table 2-15
Estimated Returns to State of Alaska from Sale of Timber

Alternative	Estimated volume (MMBF)*	Total receipts**	Estimated returns to the State
1	0	0	0
2	35	$2,265,200	$566,300
3	61	$7,515,810	$1,878,953
4	87	$4,716,270	$1,179,068
5	69	$6,352,830	$1,588,208
6	128	$12,003,840	$3,000,960

SOURCE: USDA Forest Service 1996

* Includes right-of-way volume
** Based on mid-market rates timber receipts and purchaser credit for road construction.

Table 2-16 displays the employment (jobs) and personal income (salaries) associated with each alternative averaged over a four-year period. The jobs and salaries listed include those both directly and indirectly dependent upon the timber industry.

Table 2-16
Timber Industry Employment and Income by Alternative

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Total Volume Harvested MMBF	0	35	61	87	69	128
Employment (Jobs)	0	204	344	496	392	732
Personal Income (Millions$)	0	12.1	20.5	29.5	23.3	43.6

SOURCE: USDA Forest Service 1996

All Alternatives provide sufficient volume, in combination with other scheduled offerings, to meet short-term contractual obligations to KPC and/or assist the independent timber purchasers in maintaining timber-related employment in the region. In these alternatives, the total volume (including ROW volume) harvested ranges from 35 MMBF in Alternative 2 to

128 MMBF in Alternative 6. Alternatives 3, 4, and 5 provide 61 MMBF, 87 MMBF, and 69 MMBF respectively. These volumes could be provided to KPC in harvest offerings that would meet contract requirements and maintain the volume needed to continue production. They could also be sold to independent timber purchasers.

Under Alternative 1, the no-action alternative, none of the employment described above would be supported by timber harvest activity in the Chasina Project Area. This would result in a negative effect on timber harvest employment should local timber purchasers not be able to substitute volume from another source. The effects of Alternative 1 are not predictable and could range from elimination of shifts to partial or even full shutdown of the local mills for an unspecified period of time. Selection of the no-action alternative could also have potential long-term ramifications to the contract holder, the core communities, and ultimately Southeast Alaska, through de-stabilization of the wood products industry.

The projected long-term effects of different harvest levels are contained in the TLMP RSDEIS (1996a). Timber supply analysis indicates it is unlikely that sufficient timber supply would be available within the Chasina Project Area to sustain the scheduled timber harvest through the end of the first rotation (year 2054) when second growth would become widely available for harvest. However, this conclusion depends on future timber values and whether improved or more efficient logging systems are developed to make economically marginal timber more attractive. It also depends on the status of new land use allocations that would reduce the timber base.

None of the alternatives is expected to have a significant direct impact on the commercial fishing, recreation, and tourism industries or related employment.

Issue 8: Marine Environment

Direct effects to the marine environment are assumed to occur only from development and use of LTFs, and are limited to the intertidal area affected by rock fill and either the intertidal or subtidal areas potentially affected by accumulations of bark debris.

A total of six potential LTF locations were considered for possible development. There are four existing LTF sites and two potential new sites. Three existing LTFs on Kootznoowoo Native Corporation lands (Dora Bay, Divide Head, and Port Johnson) were considered, but not needed for management of National Forest Systems Lands. The maximum number of LTFs that would be utilized under any alternative is three (two new sites and one existing site). The final selection of which LTF sites to utilize was based on the interagency guidelines (Alaska Log Transfer Facility Siting, Construction, Operation, and Monitoring/Reporting Guidelines). The U.S. Fish and Wildlife Service and the National Marine Fisheries Service staff conducted subtidal surveys at the sites that appeared to best meet the interagency guidelines. The subtidal survey reports and recommendations, which are included as part of Appendix E, were used to further define which of the potential LTF locations were preferable. Table 2-17 displays the LTFs involved in the various alternatives. See also the detailed alternative maps included with Chasina EIS.

Table 2-17
Log Transfer Facilities Required, by Alternative and System

LTF Name	Alternative						LTF System
	1	2	3	4	5	6	
Lancaster Cove	N	Y	Y	Y	Y	Y	A-Frame
West Arm Cholmondeley*	N	N	Y	N	Y	Y	A-Frame
North Arm Moira*	N	N	Y	N	N	N	A-Frame

SOURCE: USDA Forest Service, 1996

Y = Planned for intermittent use; N = Not planned for use.
* New Log Transfer Facilities.

Table 2-18 displays the number of LTFs used or developed, the total acreage of the structural embankment, and the estimated acres to be affected by bark deposition. The combination of the marine habitat covered by the structural embankment and the area potentially covered by bark deposition represents the total loss of marine benthic habitat for each alternative.

Table 2-18
Marine Benthic Habitat Affected by Alternative

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Number of LTF Sites	1	1	3	1	2	2
Structural Embankment (Acres Affected)	.23	.23	.69	.23	.46	.46
Bark Deposition (Areas Affected)	1.0	1.0	3.0	1.0	2.0	2.0
Total Acres of Marine Benthic Habitat Affected	**1.23**	**1.23**	**3.69**	**1.23**	**2.46**	**2.46**

SOURCE: USDA Forest Service 1996

Alternatives 1, 2, and 4 have no additional effect on the marine environment, while Alternatives 5 and 6 affect the marine system (2.46 acres) in a similar fashion. Alternative 3 would have the greatest impact (3.69 acres). The loss of habitat is much less than one percent of the available marine habitat in the project area. Since all species identified along the

subtidal (underwater) survey transects are common throughout Southeast Alaska, it is concluded that there would not be a significant impact to the marine environment from constructing (or continuing to use) LTFs at the proposed sites.

Mitigation Measures

TLMP Mitigation

The Forest Service uses numerous mitigation and preventive measures in the planning and mitigation of land management activities. The application of these measures begins during the planning and design phases of a project. They link to the overall Forest, Ketchikan Administrative Area, and Ranger District management direction and continue through all phases of subsequent forest management. The standards, guidelines, and direction contained in the current TLMP (1979a), the TLMP RSDEIS (1996a), Alaska Regional Guide, and applicable Forest Service manuals and handbooks have been applied in the development of alternatives and design of harvest units and roads.

Listed below is a brief summary of some of the mitigation measures common to all alternatives. Specific mitigation measures, as applied to each individual unit, can be seen in the "As Planned" Unit Layout and Road Cards. These unit and road cards are an important tool for implementing the project, as they list standards and guidelines and provide a mechanism for tracking project implementation. Unit and road cards have been developed for each individual unit that occurs in an alternative and appear in Appendix J.

Water Quality and Fish Production

TTRA, BMPs, Water Quality

Mitigation to protect water quality, fish habitat, and wetlands includes application of the Best Management Practices (BMPs) stated in the Soil and Water Conservation Handbook (USDA FSH 2509.22). This handbook provides standard operating procedures for all stream classes. In addition, the TTRA mandates a minimum 100-foot buffer on all Class I streams and on Class II streams that flow directly into Class I streams. The width of this buffer strip may be greater than 100 feet for reasons such as topography, riparian soils, a windfirm boundary, timber stand boundaries, logging system requirements, and varying stream channel locations. In addition, certain Class III streams flow directly into or have been identified as influencing Class I streams. These Class III streams have been buffered to the slope break of the channel or to a windfirm boundary to protect water quality. Split yarding or full suspension was built into the logging and transportation design process, as was partial and full suspension over wetland soils or soils with a higher mass movement potential. Direct in-stream impacts are minimized through road construction timing and fish passage requirements on certain Class I and II streams. Refer to Appendix J (Unit and Road Cards) for the unit-specific stream buffering, suspension, passage, and timing requirements being applied. When pulling culverts and bridges to close roads, stream banks will be restored to their original grade and all disturbed areas will be reseeded with the appropriate grass seed mixture. Application of BMPs and adherence to the TTRA requirements will protect water quality fish habitat and wetlands as well as riparian habitat important to other species such as deer, bear, and furbearers.

While required TTRA buffers will mitigate most temperature sensitivity concerns, there still is concern about providing topographic shading to Class III streams that flow through harvest units. Table 2-19 lists units that have characteristics (south aspect, lack of immediate downstream forested stream buffers, historical and continued harvest activities, etc.) that may

contribute to the temperature sensitivity of nearby streams. To mitigate this possible effect: (1) all deciduous trees and conifer trees less than 12 inches d.b.h. within 35 feet of Class III streams will remain standing in these units, or (2) a windfirm buffer will be applied, as negotiated by the field biologist and project forester.

Table 2-19
Units Having Buffers for Temperature Sensitivity

	Alternative(s)					
Unit Number	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
678-312			X	X	X	X
678-339						X
679-407				X		X
679-425				X		X
679-437			X	X	X	X

SOURCE: USDA Forest Service 1996

Wildlife

Mitigation measures to protect wildlife habitat are a part of the design of the alternatives, including the location of the harvest units and roads. Harvest units and roads are intentionally located away from important wildlife habitats (to the extent practicable) to reduce the effects on wildlife. Beach and estuary habitats are completely avoided by harvest units, while road incursions are minimized to the extent practicable. Where possible, disturbance of important travel corridors is minimized to allow the undisturbed movement of wildlife. Other specific mitigation measures are outlined for individual species.

Cavity and Snag Dependent Management Indicator Species

Provide for habitat requirements of cavity and snag dependent Management Indicator Species (MIS) by leaving 275 snags per 100 acres averaged over each VCU. To provide for adequate distribution of snags within VCUs which have marginal numbers of snags, the following units will have small 0.1-acre (or larger) snag patches distributed throughout the unit at a rate of 0.1 acre per 10 acres of unit. The location of these snag patches will be determined during layout or sale administration, and will be designed in such a fashion as to not impose undue safety hazards on logging contractors.

Guidelines for placement of snag patches and old-growth islands include:

- Areas where wildlife use is concentrated (determined during reconnaissance).
- Selected areas should be at least 100 feet away from unit boundary (unless the unit boundary is an existing second-growth stand; then the patch or island can be placed along the unit boundary).

- Patches or islands can be placed along split yard sections of harvest units, particularly split yard streams.
- Snag patches or old-growth islands can be incorporated into stream buffers.
- Snag patches or old-growth islands can be placed along boundaries of muskegs.

Units which will employ these snag recruitment techniques include:

677-301	677-319	678-334
677-302	677-327	680-330
677-305	677-328	679-392
677-311	678-331	681-322
677-315		

Wildlife Travel Corridors

Important travel corridors have been identified for the project area. Harvest units that occur in these corridors are recommended for partial harvest to maintain forest structure to lessen impact to wildlife mitigation and dispersal. The following units are recommended for partial harvest:

678-303	679-409	679-502
679-328	679-425	679-506
679-331	679-437	681-347
679-337	679-447	681-361
679-341	679-467	681-363
679-355	679-470	682-500
679-376	679-479	682-501
679-378	679-483	682-503
679-382		

Goshawks

Region 10 goshawk management guidelines in effect at the time of unit release will be followed. Goshawk guidelines in the TLMP RSDEIS (1996a) call for maintaining the following conditions:

> Nest Stand—Maintain an area of at least 25 acres around the confirmed nest tree (and probable nest tree if identified) and attempt to include prey handling areas, perches, and roosts. Vegetative structure objectives generally include a multi-layered, closed (over 60 percent) forest canopy, a relatively open understory with large trees (usually 20+ inches d.b.h.) and low ground vegetation. These structural characteristics generally equate to Volume Class 5 and higher in the timber resource inventory.
>
>> Management—No vegetative manipulation or new road construction is permitted. Existing roads may be maintained. Permit no continuous disturbance likely to result in nest abandonment within the surrounding 600 feet from March 15 to August 15. Activity restrictions are removed for active nests that become inactive or unsuccessful.

Nesting Habitat—Maintain an area of not less than 75 acres surrounding the nest stand (total management of 100 acres). Include inactive nest stands, hiding cover, and foraging opportunities for young goshawks. Vegetative structure is similar to the Nest Stand but may include some intermediate canopy (e.g. Volume Class 4).

Management—No commercial timber harvest is permitted within the Nesting Habitat. New road construction is permitted (outside the nest stand) if no other reasonable roading alternatives outside the mapped Nesting Habitat exist.

All new nests discovered during field reconnaissance or unit layout will be protected from timber harvest and blowdown by implementing the above measures or the Region 10 goshawk management guidelines in effect at the time of unit release.

Marbled Murrelets

Due to the limited information available on nesting habitat requirements of marbled murrelets, any nests located during field reconnaissance or unit layout will be assessed on a case-by-case basis.

Bald Eagle Nests

Road construction activities that are within a half mile of bald eagle nests will usually have blasting restricted to the period of September 1 to February 28. If the nest is unoccupied, normal blasting procedures are also permitted from June 1 to August 31, if there is no direct danger to eagles, nests, eagle nest trees, or other eagle habitat elements. Blasting within one-half mile of an active eagle nest is only allowed if: (1) the blasting can be accomplished in accordance with the requirements of the Bald Eagle Protection Act; (2) written coordination with the U.S. Fish and Wildlife Service has occurred; and (3) the results of the interagency coordination is documented. Harvest units within one-half mile of eagle nests with road construction include:

678-312	679-379	680-330
679-367	679-409	681-363
679-376	679-382	681-365

Also, as part of the Interagency Agreement between the U.S. Fish and Wildlife Service and the Forest Service, the Forest Service agrees to not have repeated helicopter flights within one-quarter mile of active eagle nests. The only harvest unit within one-quarter mile of an eagle nest that is being considered for helicopter harvest is 681-363. However, helicopter drop zones in Port Johnson and Cannery Creek areas need to take eagle nest locations into consideration, because there could be some conflicts.

Marine Mammals

Forest-wide Standards and Guidelines direct the Forest Service to prevent and/or reduce potential harassment of sea lions and other marine mammals due to activities carried out by or under the jurisdiction of the Forest Service. These have been incorporated by reference into the Chasina DEIS from the TLMP RSDEIS (1996a). These Forest-wide Standards and Guidelines to provide for protection and maintenance of harbor seal, Steller sea lion, and sea otter habitats are as follows:

1) Ensure that Forest Service permitted or approved activities are conducted in a manner consistent with the Marine Mammal Protection Act and the Endangered Species Act. "Taking" of marine mammals is prohibited; taking includes harassment, pursuit, or attempting any such activity.

2) Locate facilities and concentrated human activities requiring Forest Service approval as far from known marine mammal haulouts, rookeries, and known concentration areas as practicable. The following distances are provided as general guidelines for maintaining habitats and reducing human disturbance:

   - Facilities, camps, LTFs, campgrounds, and other developments should be located one mile from known haulouts and farther if the development is large.

   - Individuals associated with Forest Service permitted or approved activities will not intentionally approach within 100 yards, or otherwise intentionally disturb or displace, any hauled-out marine mammal.

   Several harbor seal haulout areas have been identified near the project area. They include:

   - west side of little island in South Arm
   - rocks east of Cannery Creek
   - rocks southwest of Lancaster Cove

Vancouver Canada Geese

Vancouver Canada goose habitat found during unit layout will be protected with a 410 foot buffer where management activities will be avoided, if possible, when the geese are present for nesting or brood rearing activities.

Cave/Karst Resources

Harvest unit boundaries will be modified and logging systems will be prescribed that protect cave and karst resources. Any new karst feature discovered during layout will be discussed with the Forest Geologist to assign the appropriate protection measures.

Subsistence

Because most subsistence use involves harvesting fish and game, mitigation measures that protect or enhance fish and game resources will also protect and enhance subsistence activities. By placing units and roads away from beach and estuary fringe habitats, and away from salmon bearing streams, mitigation measures were built into each of the alternatives considered in the EIS.

Recreation

North Arm Moira, Recreation

Effects of timber harvest on views from anchorages and known recreation sites will be reduced by leaving buffers of timber along the beaches and inland lakes. The proposed visual quality objectives for this plan emphasize the protection of the visual resource as viewed from saltwater, particularly in North Arm of Moira Sound. Protecting these viewsheds will reduce the direct effects on visual quality. Stream riparian buffers will protect fisheries habitat and sport angler's use of Class I and II streams in the project area.

Cultural Resources

Potential effects on cultural resources can be minimized by excluding project activities from most high sensitivity areas (exceptions are LTFs, camps, a small number of units, and access roads to these facilities). Mass high sensitivity areas were surveyed in 1995, with the remaining areas being surveyed in 1996, except for exact road locations which cannot be precisely determined until after unit and road layout occurs. Types of mitigation measures

include avoidance, protective enclosures, monitoring of harvest activities, restrictions on size or road location, and recovery and documentation of materials.

TES Plants

Choris Bog Orchid (Platanthera chorisana) is a designated sensitive species. Two populations of this species were discovered in muskeg openings during botanical surveys of the project area conducted in 1995. Populations were found within the vicinity of harvest Unit 679-363. The primary risk of perturbation to these populations would be through road construction activities. Road locations have been adjusted to avoid direct impacts to known locations of Choris Bog Orchid.

Monitoring

Monitoring activities can be divided into three broad categories: Forest Plan monitoring, routine implementation monitoring, and project-specific effectiveness monitoring. These broad types are discussed in the following sections.

Forest Plan Monitoring

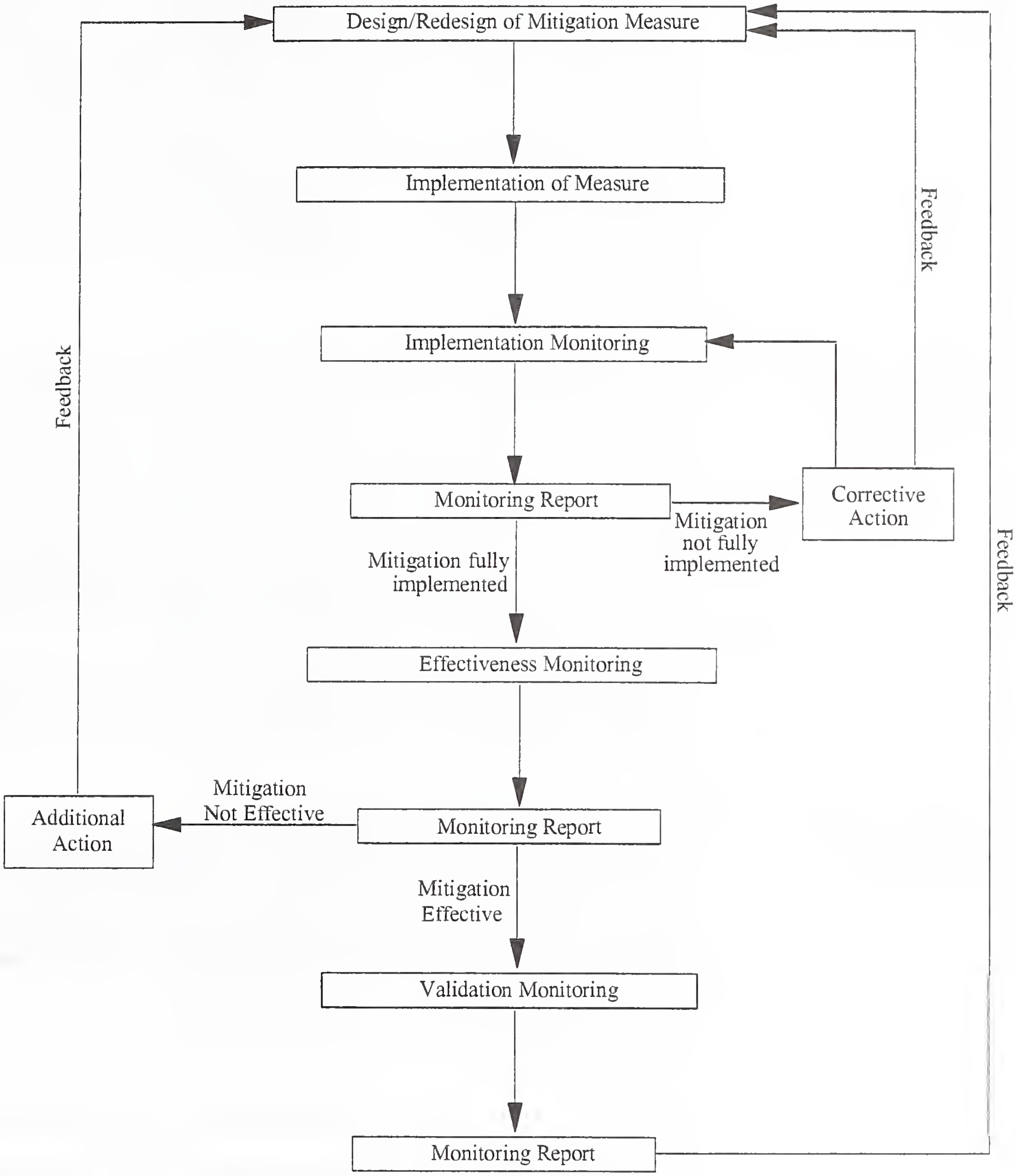
The National Forest Management Act requires that National Forests monitor and evaluate their forest plans (36 CFR 219.11). The significance of this requirement is emphasized by the recent development of a National Monitoring and Evaluation Strategy (Forest Service 1993). The Strategy is designed to focus agency attention and resources on evaluating implementation of forest plans to provide the Forest Service with information necessary to ensure responsive and efficient management of National Forests. Embodied in the National Monitoring and Evaluation Strategy are three principles: (1) evaluation of results will be readily available to the public, agencies, and other groups; (2) monitoring and evaluation will focus on ecosystems and emphasize interrelationships among biotic and abiotic components; and (3) the strategy will be flexible to meet local needs while encompassing forest, regional, and national requirements.

Three levels of monitoring are incorporated into Forest Plan monitoring and evaluation.

> **Implementation Monitoring** is used to determine if goals, objectives, standards and guidelines, and management prescriptions are implemented as detailed in the Forest Plan and project specifications;
>
> **Effectiveness Monitoring** is used to determine if goals, objectives, standards and guidelines, and management prescriptions, as designed and implemented, are effective in meeting Forest Plan goals and objectives; and
>
> **Validation Monitoring** is used to determine whether the data, assumptions, and coefficients used in the development of the Plan are correct.

Most monitoring elements involve the mitigation measures described previously. The mitigation measures are part of a process that includes these three types of monitoring to determine if the measure was implemented and is effective or needs revision. The feedback provided by monitoring results can be used to develop improved methods or additional treatments to ensure that the mitigation will be effective in the future. Figure 2-11 displays how this process of mitigation and monitoring occurs.

Figure 2-11
Mitigation/Monitoring Feedback Loop



Mitigation/ Monitoring Feedback Loop

An annual monitoring report is prepared by each Administrative Area of the Tongass and incorporated into one report at the end of each year. This report addresses all monitoring questions contained in the applicable Forest Plan; references all monitoring being conducted on the Area/Forest; assesses progress toward achieving the goals and objectives described in the Forest Plan; and either certifies that the Forest Plan is sufficient to guide management of the Forest over the next year or proposes needed changes and an approach for dealing with those changes. Forest Plan monitoring is conducted over the entire Forest on a sample basis. Samples may or may not be taken within the Chasina Project Area; however, monitoring results are designed to answer questions regarding the implementation and effectiveness of mitigation within the project area. A total of 36 implementation, effectiveness, and validation monitoring items are identified in the forest-wide monitoring plan described in the TLMP RSDEIS (1996a). All monitoring is subject to funding and personnel limitations imposed upon the Agency.

Routine Implementation Monitoring

Routine implementation monitoring assesses whether the project was implemented as designed and whether or not it complies with the Forest Plan. Planning for routine implementation monitoring began with the preliminary design of harvest units and roads. Specialists used on-the-ground inventories, computer inventories, and aerial photographs to prepare the documents called unit cards for each harvest unit in each of the alternatives. Cards were also prepared for each segment of road. Resource specialists wrote their concerns on the cards and then described how the concerns could be addressed in the design of each unit and road segment. Resource concerns and mitigation measures will be refined further during final layout when specialists will have one more opportunity to revise the unit and road card recommendations. The unit and road card documents will be the basis for determining whether recommendations were implemented for various aspects of the Chasina Project Area.

Routine implementation monitoring is part of the administration of a timber sale contract. The sale administrators and road inspectors ensure that the prescriptions contained on the unit and road cards are incorporated into contract documents and then monitor performance relative to contract requirements.

Effectiveness Monitoring

Project-specific Effectiveness Monitoring
In addition to the Forest Plan monitoring and routine implementation monitoring that will be conducted throughout the Tongass National Forest, including the Chasina Project Area, project-specific effectiveness monitoring activities are identified. Effectiveness monitoring seeks answers about the effectiveness of design features or mitigation measures in protecting natural resources and their beneficial uses. Monitoring records will be kept by the responsible staff.

Sensitive Species

Choris Bog Orchid
Objective: To provide protection of specific habitats for this species which is located in the Chasina Project Area.
Desired Result: Minimal site disturbance to populations of Choris Bog Orchid, particularly those located near harvest Unit 679-363.
Measurement: Protect known locations during sale implementation.
Threshold: Visual inspection of site indicates signs of disturbance or reduced vigor.

Corrective Action: Consult with Area TES coordinator.
Responsible Staff: CRD timber/silviculture staff.
Record of Results: Daily diaries used for contract administration. Prepare a brief report of results each year.
Annual Cost: On-going business for timber/silviculture
FTE Needs: Zero

Fisheries

Temperature Sensitivity
Objective: To determine response of water temperature in potentially temperature sensitive hydrologic systems.
Desired Result: Attainment of State Water Quality Temperature Standards (WQS) for the growth and propagation of fish, shellfish, and other aquatic life and wildlife.
Measurement: State WQS criteria for temperature for fresh water uses. Criteria will be measured prior to, during, and following project implementation. Monitoring will be implemented near the units of concern (Chapter 3).
Evaluation: Determine if selected streams meet criteria for State WQSs for fresh water uses. Determine if any deviation from WQSs can be correlated to Best Management Practices (BMP) implementation and forest management activities. Report and feedback results into validation monitoring needs and redesign of BMPs.
Responsible Staff: CRD fisheries staff.
Report of Results: Prepare a brief report.
Annual Costs: $3,500
FTE Needs: 0.1 FTE

Karst Resources

Objective: To prevent significant or permanent adverse effects to karst resources as the result of surface management activity and determine if implemented protection measures are effective.
Desired Results: Surface management activities will not have an adverse affect on karst resources and hydrology.
Measurement: Conduct field inspections on at least 25 percent of surface management activities on medium vulnerability karst.
Evaluation: Determine if mitigation was successful in avoiding any significant or permanent adverse effects to karst resources.
Responsible Staff: Forest Geologist in coordination with the Craig Ranger District.
Record of Results: Report of results to Forest Supervisor.

Validation Monitoring

Validation monitoring is conducted to show if the assumptions or models used in planning are correct. It is usually carried out at the Regional level in conjunction with research. Validation monitoring may or may not occur within the Chasina Project Area since this type of monitoring is built into a Forest-wide Action Plan.


679-414
679-413
679-422
679-420
679-497
679-433
679-441
680-330
680-335
Port Johnson
Dolomi Bay
Moss Pt
681-367
681-383
681-377
681-368
Moira Sound

01/23/97


Alternative 2
West Arm
South Arm
Dora Bay
North Arm
Port Johnson
Moira Sound
Proposed Harvest Units
State Lands
Private Lands
Projects Boundary
Streams
Existing Roads
Proposed Roads
01/23/97

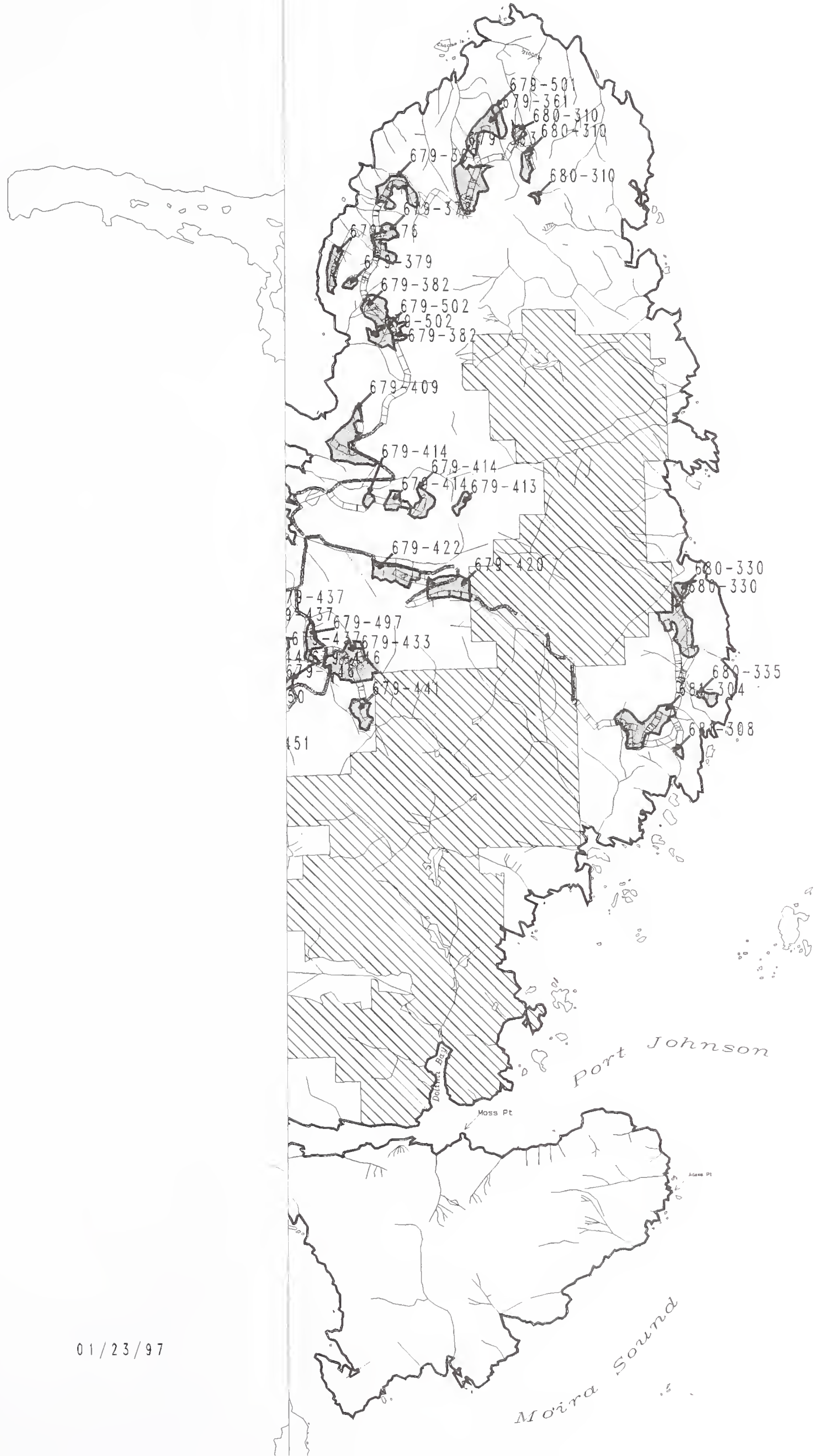
679-501
679-361
680-310
680-310
680-310
679-379
679-382
679-502
679-382
679-414
679-414
679-413
679-422
679-420
680-330
680-330
679-497
679-433
679-441
680-335
Port Johnson
Moss Pt
681-367
681-383
681-377
681-365
682-301
681-368
681-373
682-304
Moira Sound
01/23/97

Alternative 3


679-382
679-502
679-409
679-407
679-413
679-425
679-422
679-497
679-433
679-441
451
-352
681-361
681-367
681-377
681-368
681-373
682-301
682-304
682-302
682-303
Port Johnson
Moira Sound
01/23/97

Alternative 4

01/23/97


679-501
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680-310
680-310
680-310
679-379
679-382
679-502
679-382
679-409
679-414
679-414
679-413
679-422
679-420
680-330
680-330
679-497
679-433
679-441
680-335
451
Moss Pt
Port Johnson
Moira Sound

01/23/97

Alternative 5


679-501
679-361
680-310
680-310
680-310
680-317
679-379
679-382
679-502
679-392
679-384
679-386
679-403
679-407
679-414
679-413
679-425
679-422
679-420
680-330
680-330
679-497
679-433
679-441
680-335
681-308
Port Johnson
Moss Pt
681-367
681-383
681-377
681-361
682-301
681-368
681-373
682-304
682-302
682-303
Moira Sound
01/23/97

Alternative 6

Chapter 3

Environment and Effects

Outline

Chapter 3
Affected Environment and Effects of the Alternatives

Introduction

This chapter presents information about those aspects of the environment that may be affected by the activities in the proposed alternatives. The "Affected Environment" portion of each resource section describes the current condition of the resource, trends related to its status, and relevant characteristics that may be subjected to impacts from the alternatives. The "Effects of the Alternatives" portion of each section presents the direct, indirect, and cumulative effects (or impacts) of activities under the alternatives. Thus, this chapter combines into a single chapter information that in many Environmental Impact Statements (EISs) appears in separate chapters (generally called Chapter 3 "Affected Environment" and Chapter 4 "Environmental Consequences"). This chapter provides the basis for the Comparison of the Alternatives section in Chapter 2.

Available Information

The interdisciplinary team (IDT) examined the data and relationships used to estimate the effects of the alternatives. The data and level of analysis used were commensurate with the importance of the possible impacts (40 CFR 1502.15); and relevant discussion in the TLMP (1979a, as amended) and the TLMP RSDEIS (1996a) is incorporated by reference (40 CFR 1502.21).

The ecology, inventory, and management of a large forest area is a complex and developing science; the interaction of resource supply, the economy, and communities is the subject matter of an inexact science. In some cases, information gaps occur because of this. When encountering a gap in information, the IDT concluded that the missing information frequently would have added precision to estimates or better specified a relationship. However, the basic data and central relationships are sufficiently well established in the respective sciences that the new information would be very unlikely to reverse or nullify understood relationships. Thus, new information would be welcomed and would add precision, but it was not essential to a reasoned choice among the alternatives as they are constituted.

Analyzing Effects

Effects are quantified (where possible), although qualitative discussions may also be included. The means by which any identified potential adverse effects will be reduced or mitigated are described in detail in Chapter 2.

Environmental consequences are the effects of implementing an alternative on the physical, biological, social, and economic environment. **Direct** environmental effects are defined as those occurring at the same time and place as the initial cause or action. **Indirect** effects are

those that occur later in time or are spatially removed from the activity but would be significant in the foreseeable future. **Cumulative** effects result from the incremental effects of actions when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

For the purposes of this analysis, the reasonably foreseeable time frame over which the indirect effects are estimated is until the end of the Ketchikan Pulp Company (KPC) Long-term Contract (the year 2004). This determination of reasonably foreseeable is based on the time frame of the KPC contract commitment. Alternative 6 is used to display the reasonably foreseeable future actions, because this is the maximum harvest alternative, within Forest Plan standards and guidelines, and volume not harvested in other action alternatives could be harvested as part of another project by the year 2004.

The cumulative effects analysis in this document considers the Tongass Land Management Plan (1979a, as amended). The cumulative effects projected under any of the action alternatives are subject to changes when the TLMP Revision is complete. Decisions made during the revision process can provide for a new management emphasis in any given portion of the National Forest. Cumulative effects as analyzed in this document include both the effects of this project and those projected by the TLMP RSDEIS (1996a), Preferred Alternative.

The following assumptions were made to assess the reasonably foreseeable effects to the year 2004. These assumptions reflect current management and technology of national forests and provide a uniform approach to estimating effects of timber harvest and road construction.

- Laws, standards, guidelines, and Best Management Practices (BMPs) for water quality would be followed. These requirements are expected to be at least as stringent in the future as they are today.

- Timber sale planning would use an interdisciplinary process.

- All acres of suitable land, as identified in the Preferred Alternative of the TLMP RSDEIS (1996a), would be equally subject to impacts.

- The no-action alternative would represent only a delay in implementing the TLMP and, based on volume projections in the ten year timber sale action plan, foreseeable cumulative effects would begin to occur before 2004.

- Future effects on resources from timber harvest and road construction would be similar to impacts projected for current alternatives.

Potential adverse environmental effects which cannot be avoided are discussed. Unavoidable adverse effects may result from managing the land for one resource at the expense of the use or condition of other resources. Many adverse effects can be reduced or mitigated by limiting the extent or duration of effects. Mitigation measures within standards and guidelines are specified for project activities to be implemented under the alternatives. These are discussed briefly throughout the chapter, and in detail in Chapter 2.

Short-term effects are those that occur annually or within the first 10 years of project implementation. Long-term productivity refers to the capability of the land and resources to continue producing goods and services for 50 years and beyond.

Irreversible commitments are decisions affecting non-renewable resources such as soils, minerals, plant and animal species, and cultural resources. Such commitments of resources are considered irreversible because the resource has deteriorated to the point that renewal can occur only over a long period of time or at a great expense, or the resource has been destroyed or removed. For example, a rock pit which is used to provide rock to build roads throughout the project area would be considered an irreversible commitment of the resource. Land-use designations (LUDs) allowing land-altering activities were established by the Forest Plan, but the actual commitment to develop, use, or affect non-renewable resources in the Chasina Project Area was made during the development of this project.

Irretrievable commitments represent opportunities foregone for the period during which resource use or production cannot be realized. These decisions are reversible, but the production opportunities foregone are irretrievable. An example of such commitments is the allocation of LUDs that do not allow timber harvest in areas containing suitable and accessible timber lands, a decision that is made at the Forest Plan level. For the time over which such allocations are made, the opportunity to produce timber from those areas is foregone, thus irretrievable. Irreversible and irretrievable commitments resulting from this project are discussed in more detail at the end of this chapter.

Land Divisions

The land area of the Tongass National Forest has been divided in several different ways to describe the different resources and allow analysis of how they may be affected by Forest Plan and project level decisions. These divisions vary by resource since the relationship of each resource to geographic conditions and zones also varies. Four of these are used for more than one resource and are described briefly here.

Ecological Provinces

The Tongass National Forest identifies 21 large land areas that are distinguished by differences in ecological processes (TLMP RSDEIS (1996a), Chapter 3, Biodiversity). They are defined by a combination of climatic and geographic features. The Chasina Project Area lies within the South Prince of Wales ecological province (Number 18) and is discussed in the Biological Diversity and Wildlife sections of this chapter.

Management Areas

The 1979 Forest Plan (USDA Forest Service 1979a, as amended) divided the Tongass into 141 management areas, three of which are in the Chasina Project Area. Each management area has area-specific direction and activity schedules. The Tongass Timber Reform Act directed that "proportionality" (see Chapter 1, and the timber section of this chapter) be analyzed using the management areas. The 141 areas are, therefore, preserved in this analysis and are used to ensure that the proportionality requirement is met. (See TLMP RSDEIS (1996a), Chapter 5, for a detailed analysis.) Management Areas K18, K24, and K25 are within the Chasina Project Area.

Value Comparison Units (VCUs)

These are distinct geographic areas, each encompassing a drainage basin containing one or more large stream systems. The boundaries usually follow watershed divides. The Tongass

contains 867 VCUs, seven of which are found in the Chasina Area. They are used to describe the locations of specific resources in the project area. VCUs 674, 677, 678, 679, 681, and 682 are within the Chasina Area.

Wildlife Analysis Areas (WAAs)

These are Forest Service land divisions that correspond to Minor Harvest Areas used by the Alaska Department of Fish and Game. Approximately 190 apply to the Tongass National Forest, three of which apply to the Chasina Project Area. They are used in the Subsistence and Wildlife sections. Portions of WAAs 1210, 1211, and 1213 are included within the Chasina Project Area.

Geographic Information System

The Tongass National Forest has developed a computerized geographic information system (GIS) which was used for the development of this project. The GIS is a large data base containing information on many of the resources of the forest. Much of the data consists of layers, each representing a particular resource or attribute (such as vegetative species, soil types, or recreation places). This system makes it possible to do spatial analysis of alternatives and effects, and to rapidly display resource information in map (plot) format. Numerical data can also be stored, displayed, and analyzed. Specific site reconnaissance information gathered for the Chasina Project was added to the data base.

Description of the Ecosystem

Project Area

The Chasina Project Area lies within the South Prince of Wales ecological province. This Province includes Prince of Wales Island South of Selzer Portage. This Province is a combination of climatic and geographic features. The South Prince of Wales Ecological Province includes 370,594 acres, of which 68,926 acres (including 2,455 acres of saltwater) are within the Chasina Project Area.

The project area is mountainous, often rising abruptly from sea level to several thousand feet. Elevations of forested areas extend up to approximately 3,400 feet in the project area.

Abiotic Components

The configuration of the coastline, the warm Japanese ocean current, and the high coastal mountains produce abundant rainfall. Storms and moderate to heavy precipitation occur year round, but most commonly from September through November. The abundant moisture feeds numerous streams, rivers, and lakes.

The Chasina Project Area has a maritime climate, resulting from the moderating influence of the Pacific Ocean. In the summer, this provides a cooling influence, while in winter, temperatures are warmer than would be expected for these latitudes. Normal temperatures range from the mid-40s to the mid-60s in the summer, and from the high teens to the low-40s in the winter. During the warmer months, temperatures are highest inland and lowest along the coasts, while in the colder months, the reverse is true.

The local climate has had a significant influence upon the landscape ecology of Prince of Wales. Moderate temperatures and ample precipitation produce good growing conditions for commercial forest species. Relatively low annual temperatures and abundant moisture produce slow rates of decomposition, resulting in the characteristic buildup of organic matter over much of the area's landscape.

The north Pacific Ocean also generates low pressure weather systems which move onshore and produce abundant cloud cover. These low pressure systems also dominate the wind patterns. Table INT-1 displays the number of days, by month, when strong winds occurred between 1953 and 1978. Over 80 percent of the gale force winds reported in this time interval were from the south or southeast. Gale force winds occur during every month of the year, but the vast majority occur during the fall and winter months. The winds generated by these storms are significant factors in the development of forest stands. Blowdown events ranging from a few trees to several hundred acres may occur. These windthrow events, accompanied by heavy precipitation and saturation of the soil, may be a significant trigger for landslides in forested areas. Windthrow events are further discussed in the Silviculture section of Chapter 3.

The Chasina Project Area has complete cloud cover about 85 percent of the year. October is generally the wettest month. High precipitation persists through the middle of November when intermittent snowfall occurs. Snowfall varies according to elevation and distance inland from the coast. Snow accumulation below 500 feet elevation is short-lived, generally melting off within a few days due to warmer temperatures and rain.

Table INT-2 shows mean annual summer and winter temperatures, precipitation, and snowfall for the portion of Prince of Wales Island just north of the project area.

Table INT-1
Number of Days, by Month, With Winds Over 30 Miles per Hour, National Oceanographic and Atmospheric Administration (NOAA) Meteorological Station at Annette Island, Alaska, 1953-78

	Miles Per Hour						
Month	31-35	36-40	41-45	46-50	51-55	56-60	Total Days
July	3						3
August	5	4					9
September	11	7	3		1		22
October	67	45	13	4	3		132
November	58	41	5	8	1		113
December	64	39	9	9	2	3	126
January	70	29	5	6	2	2	114
February	60	31	2	8			101
March	25	9	8	4			46
April	32	9	7	2			50
May	8	5	2				15
June	11	1	1				13

SOURCE: Harris 1989.

Note: Daily fastest mile wind speed is obtained by measuring and averaging instantaneous wind velocities over 1 minute once each hour. The highest of all the 24 hourly measurements for the day is called the fastest mile and is included in published reports.

Table INT-2
Mean Yearly Summer and Winter Temperatures, Precipitation, and Snow Accumulation for Two Communities on Prince of Wales Island

Recording Station	Mean Summer Temperature (F)	Mean Winter Temperature (F)	Mean Precipitation (inches)	Mean Snow (inches)
Craig	55.0	34.8	106.47	35.7
Hollis	56.6	33.7	109.69	17.0

SOURCE: Alaska Climate Center Technical Note No. 3, 1986.

Biotic Components

The coastal forest of the South Prince of Wales Ecological Province is part of the cool, temperate rainforest that extends along the Pacific coast from southern British Columbia to Prince William Sound. Most of the forest is composed of old-growth conifers, such as western hemlock, Sitka spruce, mountain hemlock, western redcedar, and Alaska yellowcedar. Red alder is common along streams, beach fringes, and on sites recently disturbed by logging and landslides.

Blueberries, huckleberry, Sitka alder, devil's club, and salal are common shrubs in the forest. Plant growth on the forest floor includes deerheart, dwarf dogwood, single delight, and skunk cabbage. Mosses grow in great profusion on the ground, on fallen logs, on the lower branches of trees, and in forest openings.

Grass-sedge meadows usually are located along lakes and major streams. Interspersed throughout the forest are muskegs, supporting plant communities dominated by sphagnum mosses and sedges.

The alpine zone usually lies above 2,500 feet. It occupies the area above the coastal forest and is separated from the forest by a subalpine or transition zone. Alpine plants have adapted to snowpack and wind abrasion by evolving low-profile growth forms. Low, mat-forming vegetation covers most alpine areas, with cushion-like plants occupying crevices on rock outcrops and talus slopes.

The forests, shorelines, streams, and rivers of Southeast Alaska provide habitat for over 350 species of birds and mammals, including both nongame animals and animals such as black bear, Sitka black-tailed deer, moose, wolf, mountain goat, beaver, otter, and marten. Many of these are found in the project area. The coastline provides an ideal habitat for a large population of bald eagles, and wetlands provide nesting habitat for waterfowl.

A highly productive marine environment includes an abundance of marine mammals, halibut, herring, and shellfish. Both resident and anadromous fish are found within and adjacent to the project area, including five species of Pacific salmon, Dolly Varden char, cutthroat trout, and steelhead trout.

Site-specific information on biological resources in the project area follows in various sections of this chapter.

Air Quality

> **Key Terms**
>
> **Ambient Air**—that air, external to building, encompassing or surrounding a specific region.
> **Ambient Air Quality Standard**—the prescribed level of pollutants in the outside air that cannot be exceeded legally during a specified time in a specified geographical area.
> **Class I Airshed**—one of three classes of areas provided for in the Clean Air Act for the Prevention of Significant Deterioration program. Class I airsheds are the "cleanest" and receive special visibility protection.
> **Class II Airshed**—the second of three classes of areas provided for in the Clean Air Act. Class II Airsheds have no specific attainment criteria.
> **PSD**—Prevention of Significant Deterioration of ambient air quality is a program established by the Clean Air Act to protect air quality and air-quality-related values.

Affected Environment

Although there is little scientific information on the baseline air quality of the Chasina Project Area, the air quality of the region is generally good. Exchange of air typically comes from relatively pollution-free air off the Gulf of Alaska. Local sources of airborne particulates include motor vehicle emissions, motor vessels and cruise ships, dust, residential and commercial heating sources in the Ketchikan Gateway Borough population center, marine traffic on Tongass Narrows, the Ketchikan Pulp Company mill at Ward Cove, and a limited amount of prescribed burning.

Vehicles and home heating, particularly wood-fired heating, contribute to regional particulate matter concentrations. Alaska has experienced localized problems with wood smoke, and has issued regulations that limit open burning and other air pollution-generating activities in wood smoke control areas between November 1 and March 31. The wood smoke control areas do not include the Chasina Project Area. Open burning may be restricted in the project area when an air quality advisory is issued by the Alaska Department of Environmental Conservation (ADEC) (AAC 50.030). ADEC has the primary responsibility for attainment and maintenance of Ambient Air Quality Standards under the provisions of the Clean Air Act (see TLMP RSDEIS (1996a) for related air quality discussion). The Forest Service cooperates with the ADEC to protect air quality in National Forests. The entire project area is a Class II airshed for purposes of Prevention of Significant Deterioration and does not have specific attainment criteria under the Clean Air Act. There are no Class I airsheds designated in Southeast Alaska, which is a more restrictive requirement. The Clean Air Act requires air quality impact analyses for PSD sources on Class I airsheds; EPA exempts sources located farther than 200 kilometers from a Class I airshed from such analysis. The nearest Class I airshed is Denali National Park, which is approximately 1,400 kilometers away. Therefore, the Chasina Project is exempt from having to do an air quality impact analysis.

Effects of the Alternatives

Direct, Indirect and Cumulative Effects

There is presently little information on the possible effects of ambient air quality on forest resources in Southeast Alaska. Forest health monitoring recently initiated under a national resource program includes air resource related parameters. Methods of conducting inventories are being developed to address this information need. Monitoring of baseline resource conditions on the forest is being conducted at this time.

National Ambient Air Quality Standards (NAAQS) for indicators of matter less than 10 microns (PM-10) in size are established by EPA as the concentration limits needed to protect all of the public against adverse effects on public health and welfare. PM-10 indicators are utilized because the human respiratory system cannot efficiently filter out particulate matter this size or smaller. Wildfires and prescribed fires can be a source of fugitive particulate matter less than 10 microns in size.

Prevention of Significant Deterioration of ambient air quality, is a program established by the Clean Air Act to:

a. Protect public health and welfare from any actual or potential adverse effects from air pollutants not withstanding attainment and maintenance of all national ambient air quality standards.

b. Ensure economic growth will occur in a manner consistent with the preservation of existing clean air resources.

c. Preserve air quality and air quality related values in areas of special national or regional natural, recreational, scenic, or historic values.

d. Ensure that any decision to permit increased air pollution is made only after there has been adequate opportunity for informed public participation in the decision making process and after careful evaluation of all consequences.

The NAAQS for particulate matter less than 10 microns in size would not be violated by the proposed action. Prevention of Significant Deterioration increments in the Southeast Alaska Intrastate Air Quality Control Region for sulphur dioxide, oxides of nitrogen, and total suspended particulate have not yet been exceeded, making an analysis unnecessary.

All of the management alternatives are expected to have limited, short-term impacts on the ambient air-quality. Alternative 1, the no-action alternative, would result in the least emission of particulate and gaseous air pollutants in the near term. The potential for uncontrolled forest fires would be slightly higher for the action alternatives because of the logging slash created. The occurrence of forest fires, even when logging slash is present, is extremely rare in Southeast Alaska due to the annual amount of precipitation.

Local sources of airborne particulates produced or increased by the action alternatives include motor vehicle emissions, dust from road construction, residential and heating sources, marine traffic, and the Ketchikan Pulp Company mill at Ward Cove. No prescribed burning is proposed in any alternative so there will be no effect on air quality from this source. Fugitive

dust generated from construction and increased vehicular traffic may temporarily affect air quality.

The action alternatives would result in a continued supply of raw wood products to the Ketchikan Pulp Company mill at Ketchikan. This would indirectly affect air quality in the immediate area. It is KPC's responsibility to ensure that emissions from the mill are within legal limits.

The indirect and cumulative effects of the proposed action alternatives upon air quality will maintain local ambient air quality.

Photo courtesy of Leland Prater

Aquatic Resources

Key Terms

Aelvin—newly hatched salmon that are still attached to the yolk sac.
Adfluvial—species or populations of fish that do not go to sea, but live in lakes and enter streams to spawn.
Alluvial fan channel—a fan-shaped deposit of sand, gravel, and fine material made by a stream where it runs out onto a level plain or meets a slower stream.
Anadromous—fish that ascend from the sea to breed in freshwater streams .
Benthic—refers to organisms that live on the substrate at the bottom of an ocean, lake, or stream.
Channel types—the defining of stream sections based on watershed runoff, landform relief, and geology.
Estuary—relatively flat, intertidal, and upland areas where saltwater meets freshwater, as at the heads of bays and the mouths of streams.
Evapotranspiration —loss of moisture by evaporation from land and water surfaces, and by transpiration from plants.
Habitat Capability—the number of fish a particular habitat can potentially produce.
Large Woody Debris (LWD)— any large piece of relatively stable woody material having a diameter of at least 4 inches and a length greater than 3 feet that intrudes into a stream channel.
Resident fish—non-migratory fish that complete their entire life cycle in freshwater.
Salmonid—refers to the taxonomic group of fishes to which salmon belong.
Streams:
- **Ephemeral**—one that flows briefly only in direct response to precipitation in the immediate locality and whose channel is at all times above the water table.
- **Intermittent**—one in contact with the groundwater table that flows only at certain times of the year as when the groundwater table is high and/or when it receives water from springs or from some surface source such as melting snow.
- **Perennial**—one that flows continuously throughout the year.

Watershed—total land area draining to any point in a stream, as measured on a map, aerial photo, or other horizontal plane.

Affected Environment

Introduction

Abundant rainfall, geologic features and watersheds with high drainage densities provide abundant stream, lake, and riparian ecosystems in the Chasina Project Area. There are over 412 miles of streams and 1,164 acres of lakes and ponds. The 800 acres of estuaries are critical habitat for the survival of salmon and other fishes at different stages of their life cycles. These aquatic resources provide spawning and rearing habitat that support various species of salmon, trout, char and marine fishes and invertebrates (Table AQU-1). In addition to the highly valued salmonid species, several non-game fishes are known or suspected to occur in the project area. There are no reported sightings or known populations of federally listed Threatened or Endangered fish species within the Chasina Project Area.

The irregular shoreline in the Chasina Project Area has resulted in numerous small bays and a considerable amount of protected near-shore habitat. Most of these small bays are estuaries. Generally, estuaries occur where freshwater streams meet saltwater, and can be small or large in size. Estuaries are unique systems because they are the transitional zone between freshwater and marine environments, and are relatively protected sites. Estuaries are rich and diverse, harboring many resident marine species and providing food, spawning areas, or shelter for numerous other species at critical points in their life cycles (i.e., salmon). Marine invertebrates such as clams, mussels, starfish and sea cucumbers are associated with estuaries and adjacent waters. Other estuarine inhabitants include herring and smelt, which use these areas as spawning and feeding habitat. Additional species use estuaries for part or all of their life cycles, but are too numerous to list here.

Aquatic resources in the Chasina Project Area help maintain ecological and economic stability in Southeast Alaska. Local subsistence and sport anglers, and charter and commercial fishing industries depend on the fish and marine invertebrate production of Cholmondeley Sound and other waterways in the project area to support their businesses and lifestyles. Southeast Alaska provides 30 percent of Alaska's total salmon harvest (Pacific Fishing Magazine 1996). Fish are a valuable food source for other wildlife that use the forested riparian and beach habitats, and salmon carcasses replenish nutrients in the aquatic systems. The purpose of this section is to describe the current condition of the aquatic resources in the Chasina Project Area, and the effects the proposed timber harvesting activities will have on those same aquatic resources.

Table AQU-1
Fish Species Use of Chasina Project Area Streams, Lakes, and Estuary Ecotones by Life stage

Species	Life Stage Spawning	Rearing	Overwinter
Pacific Herring (*Clupea harengus pallasi*)	X 1/		
Pink salmon (*Onchorhynchus gorbuscha*)	X 2/		
Chum salmon (*Onchorhynchus keta*)	X 2/		
Coho salmon (*Onchorhynchus kisutch*)	X	X	X
Sockeye salmon (*Onchorhynchus nerka*)	X	X 3/	X
Cutthroat trout 4/ (*Onchorhynchus clarki*)	X	X	X
Rainbow trout 4/ (*Onchorhynchus mykiss*)	X	X	X
Dolly Varden char (*Salvelinus malma*)	X	X	X
Sculpin (*Cottus spp.*)	X	X	X
Stickleback (*Gasterosteus aculeatus*)	X	X	X

1/ A marine species that use near shore and estuary systems, but are not exclusive to these habitats.
2/ Pink and chum salmon utilize the estuary/freshwater ecotones after emergence.
3/ Sockeye salmon rear in lakes for 1 to 2 years.
4/ Rainbow trout, cutthroat trout, and Dolly Varden char can exhibit either anadromous or resident life history patterns.

Fish Habitat

Fish habitat is described in several ways, including: (1) stream classification, (2) watersheds, and (3) habitat capability.

Stream Classification

Stream classes are a means to categorize stream channels based on the in stream habitat and fish production value. Streams and lakes are separated into four class designations for the Tongass National Forest according to the Aquatic Habitat Management Handbook (FSH 2609.24), TLMP RSDEIS (1996a), and Regional Forester Direction (Janik 1995). Approximately 170 miles of fish-bearing streams are present in the project area. Stream Class definitions are as follows:

Class I—Class I streams are anadromous or adfluvial lake and stream habitat, high quality resident fish waters listed in Appendix 68.1 of FSH 2609.24, or habitat upstream of migration barriers known to be reasonable enhancement opportunities for anadromous fish.

Class II—Class II streams have resident fish populations and are generally at a steep (often 6-15 percent) gradient (can also include streams from 0-6 percent gradient where no anadromous fish occur). Populations in channels of this class have limited sport fisheries values; Class II streams generally occur upstream of migration barriers or have other habitat features that preclude anadromous or adfluvial fish use.

Class III—Perennial and intermittent streams with no fish populations, but which have sufficient flow or transport sufficient sediment and debris to have an immediate influence on downstream water quality or fish habitat capability.

Class IV—Intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capabilities to have an immediate influence on downstream water quality or fish habitat capability. These streams generally are shallowly incised into the surrounding hillslope.

Non-streams—Rills and other watercourses, generally intermittent and less than 1 foot in bankfull width, with little or no incisement into the surrounding hillslope, and with little or no evidence of scour.

In addition to classifying each stream, streams in the project area proposed units have been channel typed (USDA Forest Service, 1992). Channel typing stratifies lake and stream sections within a watershed into different stream process groups. The process groups are based on physical characteristics of streams and predict their physical response to different management activities. Stream class and channel type are used to develop aquatic habitat management prescriptions and protection measures to minimize fish habitat disturbance. Channel types are also used as an indicator of the amount and quality of fish habitat within the project area. The most recent in-depth description of stream process groups and channel types is found in the Channel Type User Guide, Tongass National Forest Southeast Alaska (USDA Forest Service, 1992).

The field team verified stream classes and channel types during proposed harvest unit reconnaissance. During site visits, stream classes and channel types were identified and noted on field unit cards for later transfer into the GIS stream data layer. Subsequent field reconnaissance during unit layout may identify additional streams. For those streams, the stream class and channel type will be determined and the appropriate management prescriptions applied to protect stream habitat and water quality. It is important to note that Class IV streams were newly identified in the recently published TLMP RSDEIS (1996a).

Class IV streams were not identified in the initial 1995 field reconnaissance, but will be during the 1996 field review. For a summary of miles of stream in the project area by stream class and VCU, see Table AQU-2.

Table AQU-2
Aquatic Habitats by VCU

VCU	Miles Class I	Miles Class II	Miles Class III	Acres Estuary	Acres Lakes
674	2.69	2.51	18.68	1.1	0.0
677	19.78	8.27	51.12	55.7	258.72
678	7.75	17.59	98.50	92.8	0.0
679	26.47	15.59	41.33	385.2	196.37
680	16.72	8.07	9.79	97.8	116.42
681	24.97	10.84	18.39	128.6	583.98
682	6.16	2.24	4.85	39.1	8.08
Total	**104.54**	**65.11**	**242.66**	**800.3**	**1,163.57**

SOURCE: USDA-Forest Service GIS Data Base - Streams, Lakes, and Estuary Layers

Information delineating miles of Class IV streams was not available at the time of printing the Draft

Watersheds

The project area can be categorized into a number of watersheds. Watershed delineations enable biologists to evaluate various management activities on fish habitat and a system's capability to produce fish. Many watersheds in the project area contain streams that have no name other than the ADF&G Anadromous Stream Catalog number. Several of these streams are important to salmonid production within the project area. See Table AQU-3 for identification of important anadromous streams.

Table AQU-3
Major Salmon Producing Streams Within The Project Area and Salmon Species Present

VCU	Stream Name or LOC and #	Watershed Number	Anadromous Miles	Resident Miles	Watershed Acres	Fish Species
674	Cannery Creek #102-40-10520	H21A	2.69	2.42	1,842	Pink, Chum
678	South Arm E #102-40-10430	H06A	1.43	0.78	987	Pink, Chum, Coho
678	South Arm W #102-40-10470	H05A	0.67	0.64	1,184	Pink, Chum, Coho
679	Horseshoe Canyon #102-40-10150	H59A	1.36	0.1	970	Pink, Chum, Coho
679	Kitkun Bay #102-40-10170	H50A	0.95	0.51	705	Pink, Chum, Coho
679	N. Lancaster #102-40-10090	H63A	1.30	0.0	842	Pink, Chum
679	Triangle Creek #102-40-10110	H62A	3.53	0.44	867	Pink, Chum, Coho
682	Nowisky Cove Creek #102-30-10910	H49A	1.65	1.55	734	Pink, Chum

Table AQU-3 summarizes additional information on these important stream systems within the project area and salmon species found in them.

Figure AQU-1
Chasina Project Area Watersheds (Study Watersheds Shaded)

Sediment Transfer Index

The Chasina Project Area (Figure AQU-1) had three watersheds (H59A, H62A, and H63A) that were evaluated for potential hydrologic impacts using a watershed-level analysis (Geier and Loggy 1995). The results of the analysis are discussed for each watershed later in this section. A Sediment Transfer Index (STI) was calculated for each watershed. The STI is a quantitative measure of watershed characteristics likely to influence flow and sediment regimes. The STI is composed of three sub-indices based on watershed morphology, discharge, and potential sediment sources.

Watershed Morphology

The first component of the STI characterizes the morphology of each sub-basin and reach according to transport characteristics by using the product of drainage density and relief ratio (Simons et. al., 1980). Drainage density (total stream length/area) is used as a measure of drainage efficiency. Sub-basins or reaches with greater stream length per unit area are more efficient at transporting sediment to the outlet. Relief ratio (basin relief/length) is used as a measure of basin energy. Sub-basins or reaches with higher relief ratios have greater gravitational energy available for sediment transport. The product is an indicator of water and sediment yield (Simons et. al., 1980) and is used as the geomorphic component of the STI

Discharge

The geomorphic component of each index is adjusted for discharge using the estimated bankfull flow i.e., 2-year flood) for each sub-basin or reach. Streams with higher discharge have greater stream power and sediment transport capacity (Brooks et. al. 1992). Bankfull flow, which is highly-correlated with channel formation (Dunne and Leopold 1978), was used as the reference flow and estimated by using a regional hydrologic model for Southeast Alaska (Jones and Fahl 1994).

Sediment Sources

The final transport and depositional indices were derived from the discharge-weighted geomorphic components by incorporating potential sediment sources. Four major categories were used: natural sources, harvest units, roads, and landslides (Geier and Loggy 1995). The final transport and depositional indices are called the Sediment Transport Index (STI).

Interpretation

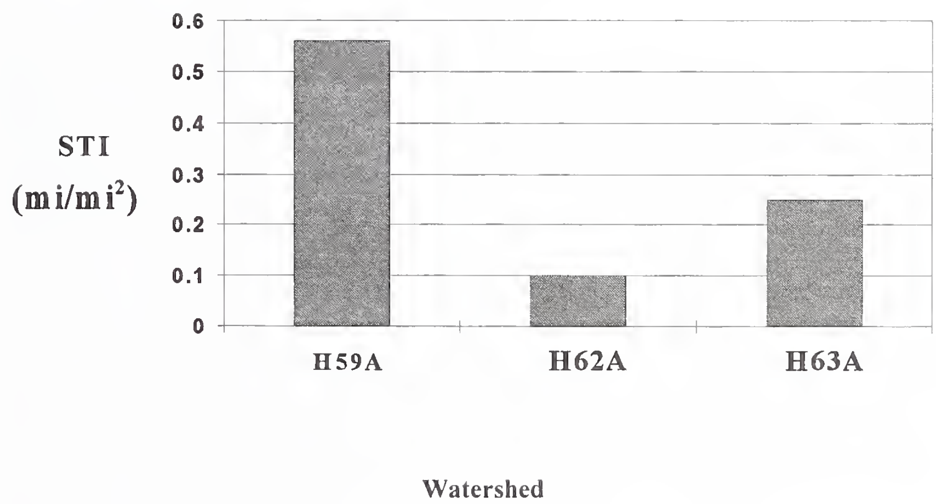
The STI is a quantitative indicator of potential watershed impacts for each management alternative. It measures watershed disturbance in acres per unit area and gives a weight according to watershed morphology and percent source area (estimated by MMI 3 and MMI 4 soils). The watershed morphology index, or Texture-Slope Product (TSP), reflects transport efficiency (drainage density) and potential energy available for transport (relief ratio). Watersheds with a high TSP tend to move water, sediment and other materials quickly through the system. The methodology assumes that fish habitat in valley-bottom portions of high STI watersheds are at greater risk because materials introduced into streams by disturbance in the upper reaches can be transported quickly and efficiently into valley-bottom areas and upset the natural equilibrium of the streams. The STI does not estimate water yield, sediment discharge, or sediment routing, or where impact thresholds occur. It does, however, indicate which management alternatives have the greatest potential impacts based on measured characteristics known to correlate with flow regimes, sediment transport, and deposition.

Analysis

H59A Watershed Assessment. Watershed H59A is a 2nd order watershed that covers an area of approximately 1.5 sq. mi. (970 acres). In its undisturbed or reference condition, the analysis indicates that H59A is the most hydrologically sensitive of the three watersheds (Figure AQU-2). H59A has the greatest potential source area (based on the percent of MMI 3 and MMI 4 Soils within the watershed) of all three watersheds (21 percent compared to 0 percent for H62A and 5 percent for H63A). It also has the highest Sediment Transfer Index (STI = 0.56), which indicates it has the greatest potential of the three watersheds to move materials from headwaters and side slopes into valley bottom fish habitat. H59A has the greatest change in elevation (1,760 feet), combined with the shortest basin length (9,270 feet), giving it the greatest relief ratio (0.19). This means that H59A has, overall, the greatest amount of gravitational energy available for transporting water and materials out of the headwaters and side slopes to the valley bottoms. The longitudinal profile is highly convex (Figure AQU-3), further indicating that any material introduced into streams in upland areas of the watershed can be transported quickly and efficiently to low gradient reaches downstream.

Figure AQU-2

Sediment Transfer Index (STI)



Existing disturbance in H59A includes approximately 82 acres of harvest (8 percent) and 1.6 miles of road. Although the existing management levels are low, future activities in headwaters and steep side slopes of H59A have the highest potential of the three watersheds for affecting flow and sediment regimes. H59A has the highest mean annual flow of the three (Figure AQU- 4). As indicated by the Texture-Slope Product (relief ratio x drainage density), it is also likely to be the “flashiest” of the three, delivering the greatest amount of water

downstream in the shortest amount of time. Extensive timber harvest tends to reduce the amount of water loss to evapotranspiration, making more water available for streamflow. This can translate into higher peakflows and higher flood volumes during storms. There are no mapped riparian fens in H59A to buffer downstream areas against increased peakflows, which increases management risk. H59A also appears to have the highest potential for low-flow impacts following timber harvest. The lack of valley-bottom or foot slope fens results in a reduced retention capacity for sustaining streamflow during drought periods.

Figure AQU-3
Longitudinal Profile of Selected Chasina Watersheds

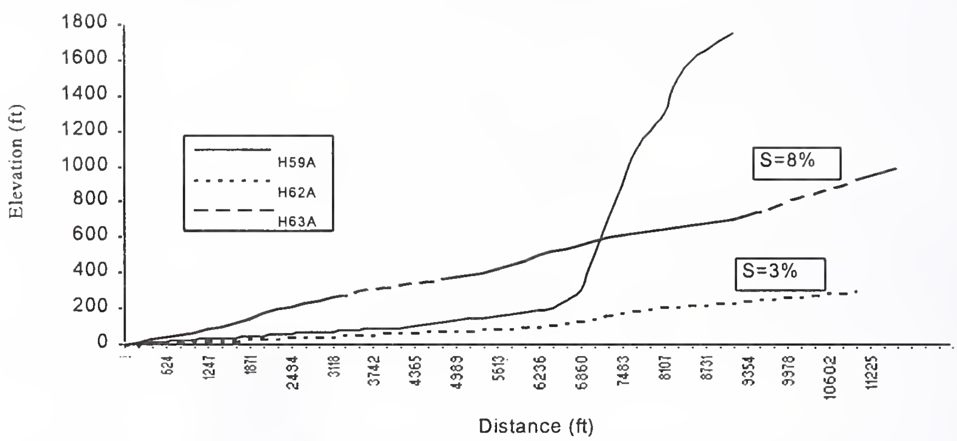
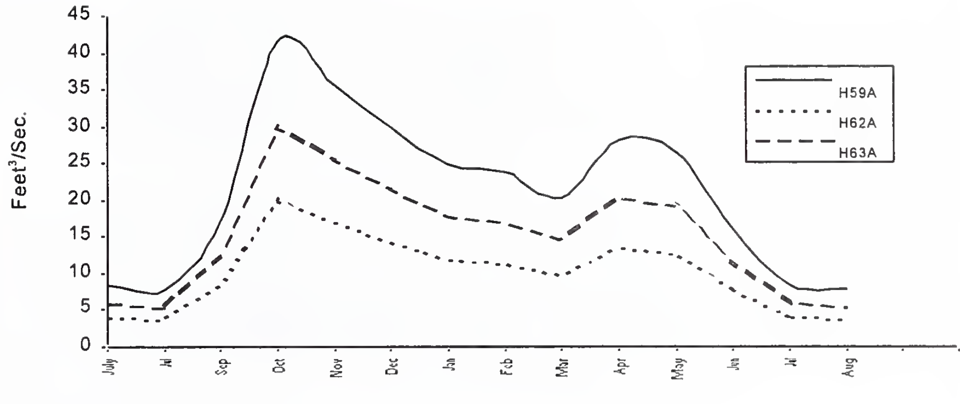


Figure AQU-4
Mean Monthly Flow (cfs) of Selected Chasina Watersheds



H62A Watershed Assessment. Watershed H62A is a 3rd order watershed that covers an area of approximately 1.4 sq. mi. (867 acres). In a hypothetical undisturbed condition, the analysis indicates that it is the least hydrologically sensitive of the three watersheds (Figure AQU-2). H62A has no high mass movement index soils (MMI 3 or MMI 4). It also has the lowest watershed relief (300 feet) and the lowest relief ratio (0.03) of any of the three watersheds, indicating that H62A has, overall, the least amount of gravitational energy available for transporting water and materials out of the headwaters and side slopes to the valley bottoms. The longitudinal profile is linear in form (Figure AQU-3), and is generally of low gradient (2.8 percent). The low gradient and low energy indicates low transport capability. Compared to H59A, materials introduced into streams in upland areas of H62A cannot be transported as quickly or efficiently into the valley bottoms. Management activities in H62A have the lowest potential of the three watersheds for affecting flow and sediment regimes. H62A has the lowest mean monthly flow of the three watersheds (Figure AQU-4), and the texture-slope product (relief ratio x drainage density) indicates that peak flows during large events are not likely to be as high as for H59A.

H63A Watershed Assessment. Watershed H63A is a 3rd order watershed that covers an area of approximately 1.3 sq. mi. (842 acres). In a hypothetical undisturbed condition, the analysis indicates that its hydrologically sensitivity would be intermediate between H59A and H62A (Figure AQU-2). H63A has 41 acres (4.9 percent) of its soils in MMI 3 and MMI 4. It also has an intermediate value for watershed relief (1000 feet) and an intermediate relief ratio (0.09). Similar to H62A, H63A has a linear longitudinal profile, but with a steeper gradient of 8 percent (Figure AQU-3). Consequently, materials introduced into the mainstream of

H63A tend to be transported quickly and efficiently out of the watershed during high flow events, but will tend to accumulate in localized low-gradient reaches during low and moderate flow events. This local accumulation between storm events may present the greatest potential hazard to fish habitat. Management activities in H63A appear to have the potential to affect flow and sediment regimes. H63A also contains karst landforms and several resurgences influence streamflow regimes.

A primary concern in H63A is the cumulative impacts of harvest, because of the amount of previous harvest in the watershed. Thirty-nine percent (39 percent) of the watershed was harvested in 1989, compared to 8 percent for H59A and 13 percent for H62A. The harvest was pre-TTRA and there were no requirements to leave buffers along the riparian corridor for habitat protection.

Harvest Unit Analysis

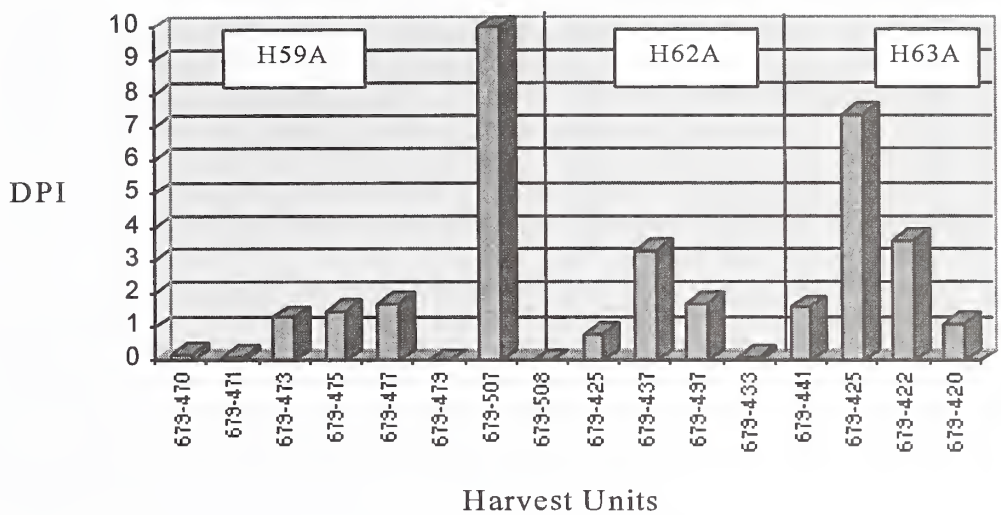
Individual harvest units in each watershed were analyzed for potential risk to downstream fish habitat. The procedure rates each harvest unit based on three risk factors including estimated magnitude of impact, extent of hydrologic connection, and energy available for transport (Geier 1996, in press). First, the magnitude of potential impact was estimated using the area of each harvest multiplied by its slope. Second, the extent of hydrologic connection was estimated by the length of stream draining the unit. Finally, the energy available for transport was estimated using the average valley slope between the harvest unit and downstream fish habitat. The factors were combined into a dimension less Delivery Potential Index (DPI) for each harvest unit as shown in Figure AQU-5. The three units with the highest risk factors are discussed below.

Unit 679-507 in watershed H59A has the highest risk index of the harvest units analyzed (DPI = 10). It is only the fourth largest of the units analyzed (55 aces), but is situated on steep slopes (75-100 percent) and has three mapped streams totaling 4,000 feet in length connecting it to downstream fish habitat. It is also in relatively close proximity (400 feet) to fish habitat. Materials introduced into streams have a high potential to be transported to downstream fish habitat.

Unit 679-425 and 679-422 in watershed H63A have the second and third highest risk indices of the harvest units analyzed (DPI = 7.4 and 3.6, respectively). Unit 679-425 covers 111 acres and has approximately 2,700 feet of designated 100-foot TTRA buffer adjacent to fish habitat. It is not particularly steep (35-55 percent), but its size and close proximity to fish habitat give it the highest risk rating in H63A. Unit 679-422 has a DPI of 3.4 due primarily to its proximity to fish habitat (250 feet), and two mapped streams totaling 1900 feet in length which connect the unit to downstream fish habitat.

For information on BMPs and mitigation measures, see Appendix J—Unit and Road Cards.

Figure AQU-5
Delivery Potential Index (DPI)



Habitat Capability

The third criteria defining fish habitat is habitat capability. Maintaining or improving habitat capability to produce salmon is a primary management goal of the Forest Service. Although the Forest Service does not have jurisdiction over escapement, the agency is concerned about maintaining escapement in sufficiently high numbers of adult salmon to seed the available habitat. Adult spawner escapements depend on numerous factors other than by changes in upland management, such as commercial fishing harvest rates and ocean survival.

Loss and degradation of freshwater habitats are the most frequent factors responsible for the decline of anadromous salmonid and resident fish stocks. This includes decreases in the quantity and quality of habitat and fragmentation of habitat into isolated patches. On federal lands, the most significant management activities affecting fish habitat are timber harvest and associated activities (i.e., road building and increased recreational activities).

Several factors affect habitat capability within the stream environment. Key physical components of a fully functioning aquatic ecosystem include complex habitats consisting of floodplains, banks, channel structure (i.e., pools and riffles), water column, and sub-surface waters. These are created and maintained by rocks, sediments, large wood, and water quantity and quality. Upslope and riparian areas influence aquatic systems by supplying sediment, large wood, and water. Disturbance processes such as land slides and floods are important

delivery mechanisms of these three components. Not all of the desired habitat features are expected to occur within a specific reach of stream, but they do occur frequently throughout a productive watershed.

A brief summary of some of the major environmental factors affecting fish production within stream systems is described below.

Large Woody Debris

Large quantities of downed trees are a functionally important component of stream habitat. Large woody debris (LWD) influences channel morphology by affecting pool formation, channel pattern and position, and channel geometry. Wood enters fish-bearing streams from either the adjacent riparian zone or the tributaries flowing down the hillslopes. LWD partially controls downstream transport of sediment and organic matter by storing the material behind large wood. LWD affects distribution, formation, and complexity of habitat units, provides cover for fish, and acts as a substrate for aquatic invertebrates and vegetation.

Due to human activities, many riparian management areas on federal lands are inadequate as long-term sources of large woody debris. In several watersheds within the Chasina Project Area, future sources and amounts of large wood have been reduced due to past and present timber harvesting practices and related activities. Timber harvest activities decrease the widths of intact riparian areas. In areas where riparian buffers are established, partial harvest and salvage logging within them reduce their ability to contribute large wood to streams. Even lack of protection in riparian areas for nonfish-bearing streams decreases the amount of wood these streams could deliver to fish-bearing streams further downstream in the system.

Under natural conditions, large woody debris is periodically supplied by old-growth riparian forest. LWD is usually contributed by windthrow, undercut stream banks, and side-slope sloughs. Gradual and consistent entry of LWD into the aquatic system is important to maintain stream habitat diversity, stability, and productivity. Large amounts of LWD entering abruptly can be detrimental to the aquatic ecosystem by becoming a physical barrier, causing bank erosion, and provoking channel migration. In harvested timber units buffer blowdown contributes LWD to stream systems, but it occurs within a short period of time, usually causes channel or bank damage, and decreases future recruitment potential.

Site-specific fisheries mitigation measures such as stream and lake protection zones, timing, and road crossings are contained on the Unit Cards (Appendix J).

Stream Temperature

Vegetative shading of streams is important because changes in water temperature regimes can affect the survival and production of anadromous and resident salmonids. Increased water temperatures are often related to the removal of streambank vegetation along the mainstem and tributaries of a stream during timber harvest. Removal of vegetation uncovers greater surface area of a stream, which allows solar radiation to warm the water faster. According to State of Alaska Water Quality Standards for the growth and propagation of fish and other aquatic life, water temperatures shall not exceed 65° Fahrenheit (F) at any time. The maximum temperature shall not exceed 58° F for fish migration and rearing, and 56° F for spawning, egg, and fry stages.

Generally, reductions in canopy cover results in higher summer temperatures and lower winter temperatures. In the summer, solar radiation is the primary reason for stream temperature fluctuation. Adult fish become stressed as the water temperature increases; when the water reaches the upper lethal limit, a fish kill results. Small changes in water temperature can also affect the emergence of fry from the gravels and the migration of juveniles to the ocean.

Several watersheds within the Chasina Project Area have already experienced a fairly significant amount of timber harvest. Most of the harvest occurred before the enactment of the Tongass Timber Reform Act (TTRA) of 1991. Consistent with other areas that were harvested prior to TTRA, timber was harvested to the edge of the streams, leaving little or no vegetative buffer on the streambanks. Impacts on the water temperature of these systems will continue until natural reforestation replaces the canopy cover.

The 1991 TLMP Draft Revision proposed that no more than 35 percent of the land area in a watershed be commercially harvested within a 15 year timespan. This allows for recovery of the watershed from harvest activities and a reduction of stream temperature sensitivity before any additional harvest takes place (USDA Forest Service 1991a). Since sensitivity to disturbance is variable between watersheds, the TLMP RSDEIS (1996a) recommends that the rate of timber harvest entry into individual watersheds be analyzed for cumulative effects at the project level. This document identifies and analyzes watersheds that are at risk of reaching or exceeding the 35 percent rate of timber harvest entry.

Sedimentation

Accelerated rates of erosion and sediment yield are a result of many forest management activities. Roads are probably the greatest source of management-accelerated sediment delivery to anadromous fish habitats. Many older roads with poor locations and inadequate drainage and maintenance increase the risk of erosion and sedimentation of stream habitat.

Roads have unavoidable effects on streams no matter how well they are designed, located, or maintained. Roads modify natural hillslope drainage systems and accelerate erosion processes. These changes can alter physical processes in streams, leading to changes in streamflow regimes, sediment transport and storage, channel structure, substrate composition, and stability of sideslopes. Altering the physical process of a stream can significantly impact biological processes in the same stream system.

Increased levels of sedimentation, both deposited and suspended, frequently have adverse impacts on aquatic productivity. Fine sediments deposited in spawning gravels can reduce survival of fish eggs and developing alevins by smothering the eggs and blocking emergence paths of the alevins. Sediments can also fill pools, which reduces available rearing habitat for juveniles and resting habitat for adults. As sediment levels increase, fish food availability is reduced as primary production and benthic invertebrate productivity decreases; since salmonids are sight feeders, feeding and social behavior can be disrupted by increased levels of suspended sediments.

Due to the adverse biological and physical impacts of increased sedimentation in stream systems, road and fish-pass stream crossing construction activities are allowed to occur within constrained time frames. In Class I streams, road construction activities are not allowed to occur from the time the adults enter the stream system for spawning until the emergence of the fry from the gravels. The windows for instream operations can vary slightly from stream to stream and between species. In the Ketchikan Area of the Tongass National Forest, the

windows during which instream work may be conducted are generally June 1 to August 7 for pink and chum salmon, June 15 to September 1 for coho salmon, and July 18 through August 7 for steelhead trout and sockeye salmon. However, these operations windows can vary from site to site within the stream system and throughout the project area. Site-specific information on timing restrictions may be found in Appendix J—Unit Cards.

Management Indicator Species

Management Indicator Species (MIS) are species whose population changes are believed to best indicate the effects of land management activities (USDA Forest Service 1982). Through the MIS concept, the total number of species occurring within a project area is reduced to a manageable set of species that collectively represent the complex of habitats, species, and associated management concerns. The MIS are used to assess the maintenance of population viability, changes in biological diversity, and effects on species in public demand.

For the Chasina Project, coho and pink salmon, and Dolly Varden char are the MIS used to evaluate the environmental consequences of the alternatives on fish habitat capability. The models are indicators of projected changes in habitat due to management practices. Their purpose is to assist in making comparisons between management alternatives. The results from the habitat capability models can not be interpreted as precise estimates of rearing fish biomass or actual fish production.

Coho and pink salmon were selected to represent two different phases of salmon life history: spawning/egg incubation and freshwater rearing. Anadromous fish spend part of their life cycle in freshwater and part in saltwater. Salmon lay their eggs in the stream gravels and the juveniles emerge from the gravels as they hatch. Depending on the species of the salmon, the amount of time the juveniles spend in freshwater before migrating to the ocean varies. Pink salmon are especially dependent on estuaries during their early life stages. Salmon reach maturity out in the ocean, and return to their natal streams to spawn and die. Dolly Varden char was selected to represent resident species due to their wide distribution and habitat requirements. Habitat capability for this species is limited by the quantity and quality of spawning gravels, and relatively deep pools as overwintering habitat. Resident char and trout spend their entire lifecycle in freshwater.

Coho Salmon

Coho salmon are highly dependent on quality rearing habitat for their survival. Coho juveniles spend an average of 2 years in freshwater streams before migrating to saltwater. On average, smolts mature in an additional 2 years in the ocean, and reach 6 to 20 pounds. The adults are important to the commercial and sport fishing industries of the Chasina Project Area. In 1995, ADF&G Commercial Fisheries Division reported that District 102 (includes the Chasina Project Area) contributed 69,303 coho to the Alaskan fishing industry.

Due to the extended amount of time coho juveniles spend in freshwater, their habitat capability is not only limited by the quantity and quality of spawning gravels, but also by the amount of overwintering habitat present. LWD is critical in providing sufficient quality overwintering and rearing habitat in the form of backwater ponds and deep pools for juvenile coho. Past management activities, such as clearcutting timber to the edge of streambanks, have reduced LWD recruitment, disturbed side-channel habitat, and decreased winter stream temperatures. Due to the importance of LWD for coho production, its abundance in streams is

a major parameter used in the coho habitat capability model (TLMP 1991a). Coho habitat capability, displayed in Table AQU-4 represents the estimated potential for coho salmon production in the Chasina Project Area.

Pink Salmon

Pink salmon are the most widely distributed salmon in Southeast Alaska. Pink salmon are important to the commercial fishery of Southeast Alaska, where they represent the greatest poundage harvests. ADF&G Commercial Fisheries Division announced that District 102 (includes the Chasina Project Area) provided 8,860,749 pink salmon to the commercial fishing industry in 1995. Pink salmon juveniles go to sea immediately upon emergence from the gravels of coastal streams. After maturing in the ocean for 2 years, pinks return to their natal streams to spawn and die. Spawning gravel quantity and quality limits pink salmon spawning habitat capability. Substrate composition, water quality and quantity, and water depth and velocity are critical to successful salmon spawning and incubation. Spawning generally occurs in riffles as incubating eggs need a constant supply of clean well-oxygenated water.

Management actions that increase stream sediment levels, destabilize stream spawning habitat, and alter habitat accessibility to migrating juveniles and adults harms spawning and incubating habitat. Increased sediment levels can affect egg survival by depriving the eggs of oxygen. Activities that affect fish passage, reduce migratory holding areas, increase stream temperature, and decrease dissolved oxygen can also effect juvenile and adult migration. Migratory holding areas are deep, quiet pools where adults like to rest. Timber harvest near a stream can cause changes in streambank stability, lateral scouring and sedimentation. These factors affect a watershed's ability to retain storm runoff and flood waters.

The model estimates of pink salmon habitat capability are based on estimates of available spawning habitat in the VCU streams. This was done by first determining average pink salmon spawning area by channel type for Tongass National Forest streams that are typically used by pink salmon and not other salmonids. These estimates were then applied to streams in each VCU that have access by pink salmon. Unlike coho habitat capability estimates, pink salmon model estimates are not influenced by prescribed logging activities. This is because the limited studies conducted inside Southeast Alaska have not shown a direct tie between upland (land not immediately adjacent to streams) management and pink salmon numbers; therefore, effects of past management activities on pink salmon are not quantitatively evaluated with the habitat capability model. Table AQU-4 represents the habitat capability changes between 1954 and 1994.

Dolly Varden

Spawning gravel, water quality and quantity, and water depth and velocity are important habitat components for Dolly Varden spawning and successful egg incubation. Dolly Varden, like coho salmon, are highly dependent on quality rearing habitat for their health, growth, freshwater survival, and marine survival. Dolly Varden can be either resident or anadromous; the resident form spends its entire life cycle in freshwater systems. Anadromous Dolly Varden juveniles spend 1-4 years in freshwater before migrating to saltwater. Since Dolly Varden juveniles spend a significant amount of time in freshwater before migrating to sea, their habitat needs are quite similar to coho salmon habitat needs. Dolly Varden habitat capability, like coho habitat capability, is directly influenced by LWD recruitment. Table AQU-4 shows

Dolly Varden habitat capability effects and percent change from 1954 to 1994. Reductions in habitat capability due to previous harvesting practices may be offset by stream rehabilitation over an extended period of time.

Table AQU-4
Habitat Capability Effects and Percent Change from 1954 to 1994 for Coho and Pink Salmon, and Dolly Varden Char

Species	1954	1994	%
Coho Salmon	8,693	7,616	-12.4
Pink Salmon	11,444,891	11,444,891	0
Dolly Varden	110,958	97,134	-12.5

SOURCE: USDA-Forest Service Ketchikan Area GIS Data Base

Legal Requirements and Riparian Habitat Protection

Stream systems and adjacent riparian areas are incredibly productive and diverse habitat for both aquatic and terrestrial flora and fauna. Streams and riparian areas are also sensitive to disturbance. Some disturbance, such as windthrow and high water flow events, are a natural part of a healthy, functioning riparian ecosystem. Escalated rates of disturbance, such as can be caused by timber harvesting and road building, generally has a negative effect on streams and their adjacent riparian areas (increased levels of sedimentation, disturbance of water courses and flow, removal of snags, den trees, and over-story canopy, etc.), and can impair their functionality.

Recognizing the importance and fragility of streams (relative to fish habitat) and riparian areas, Congress has set minimum standards for the protection of these areas in two different Acts; both Acts emphasize the protection of fish habitat, but in the process of doing so, some of the riparian areas also receive consideration for protection. The National Forest Management Act (NFMA) sets the minimum standards for fish habitat protection on all National Forests. The NFMA regulation (36 CFR 219.27(e)) state, in part:

> *"No management practices causing detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment shall be permitted within these areas [riparian areas] which seriously and adversely affect water conditions or fish habitat."*

In accordance with the NFMA stipulation to protect fish habitat and riparian areas, the Tongass Land Management Plan (TLMP) provides standards and guidelines for stream, lake, estuary, beach, and riparian area protection (TLMP RSDEIS 1996a). These standards and guidelines are in accordance with the second Act that Congress passed for fish habitat and riparian area protection; this act is known as the Tongass Timber Reform Act of 1990 (TTRA).

TTRA, Section 103(a) provides direction for fisheries protection. The objective of this section of TTRA is to protect riparian areas and fisheries resources by applying Region 10 best management practices (BMPs) to projects within these areas, and applying buffer zones a minimum of 100 feet in width on Class I streams and Class II streams flowing directly into Class I streams. The Act states:

> *(A) Section 705 (16 U.S.C. 539d) of ANILCA is amended by adding at the end thereof the following new subsection: "(e) in order to assure protection of riparian habitat, the Secretary shall maintain a buffer zone of no less than 100 feet in width on each side of all Class I streams in the Tongass National Forest, and on those Class II streams which flow directly into a Class I stream, within which commercial timber harvesting shall be prohibited, except where independent National Forest timber sales have already been sold.....The Secretary shall use best management practices, as defined in the Region 10 Soil and Water Conservation Handbook (FSH 2509.22), January 1990, to assure the protection of riparian habitat on streams or portions of streams not protected by such buffer zones. For the purposes of this subsection, the terms Class I streams and Class II streams means the same as they do in the Region 10 Aquatic Habitat Management Handbook (FSH 2609.24), June 1986."*

TTRA provides protection to Class I streams and Class II streams flowing directly into Class I streams. There are, however, many Class II, III, and IV streams that do not meet the criteria for protection through TTRA. For those streams not addressed by TTRA, the Region 10 Aquatic Habitat Management Handbook describes the minimum protection standards for management practices in Aquatic Habitat Management Units (AHMU).

Protection measures along lakes, streams, and riparian areas are known as buffers; they are designed to maintain the integrity and function of riparian areas. Buffers are prescribed for streams based on stream class and channel types. Minimum buffer standards and guidelines are found in the TLMP RSDEIS (1996a) and in Appendix C of this document. Wider buffers or other protection measures can be specified on specific sites in order to maintain or enhance fish habitat, water quality, or riparian areas. For ease of reference, Tables AQU-5, 6, and 7 delineate buffers by channel type, type of buffer, and stream or lake class. The buffer that directly effects the configuration of an individual unit is the implementation buffer. All buffers in these tables meet the minimum requirements of TTRA and AHMU.

The buffers listed in Tables AQU-5, 6, and 7 are minimum horizontal widths on one side of the stream channel. The total width may equal or exceed this distance depending on site-specific slope. There are four types of buffer widths described in these tables: no commercial harvest, no programmed harvest, uneven-aged management, and implementation buffer. Two additional components in crafting buffers are riparian management area (RMA) widths and site potential tree height. A brief description of each follows.

1. No Commercial Harvest Buffer: A minimum 100-foot buffer is applied to each side of all Class I streams and also Class II streams that flow directly into Class I streams, as specified in the Tongass Timber Reform Act. No commercial harvest is allowed within the buffer, although limited clearing for road building is permitted.

2. No Programmed harvest Buffer: This buffer is applied primarily to alluvial fan, floodplain, and estuary channel types. If a no commercial harvest buffer is present, the no

programmed harvest buffer width is added to it. Programmed harvest activities are precluded within this buffer, but salvage and individual tree cutting may occur.

3. Uneven-aged Management Buffer: An uneven-aged management buffer is designated on several channel types, including some of the alluvial fan and floodplain process groups, and many lakes. Within this buffer, selective harvest of trees is allowable in accordance with specific direction provided in the Riparian Standards and Guidelines (TLMP RSDEIS 1996a). The uneven-aged management buffer is additional to any no commercial or no programmed harvest buffers present on a stream reach or lake.

4. Planning Level RMA Width: All channel types not receiving at least a 100-foot buffer from one or more of the first three buffer components receive a planning level buffer of a minimum 100 feet. The area within this zone is available for harvest when harvesting activities meet riparian area management objectives for fish habitat and water quality.

5. Site-Potential Tree Height: This refers to the ability of a specific site to grow trees to a certain average height. Since large wood recruitment to the aquatic ecosystem is a primary concern, the maximum average tree height is one of the greatest width concerns for large wood recruitment. The average tree height for each channel process group is used to establish minimum buffer widths.

6. Implementation Buffer: This buffer takes into account the conditions of the previous five components and is the minimum buffer width implemented along a specific channel type within a harvest unit. For Class I and II streams and lakes, the minimum implementation buffer is at least equal to the site-potential tree height. The implementation buffer is always consistent with TTRA, and Forest Plan Standards and Guideline requirements.

There are other requirements for determining buffer size that are not displayed in Tables AQU-5 through 7. Some examples include the presence of riparian soils, very high mass movement soils (MMI 4), tree crowns that do not extend beyond the slope break, and 50 percent natural shading maintained on temperature-sensitive systems. If present upon site-specific analysis, any of these components can widen the buffer zone beyond the minimums in order to meet riparian area management objectives. See the Riparian Management Area section for additional discussion and requirements. Discussion includes total acreage harvested in riparian management areas and the effects of harvest on this sensitive environment.

Estuaries and Beach Fringe

Estuary and beach fringes are areas of essentially unmodified old-growth forest that are located along shorelines adjacent to saltwater. The estuary fringe is approximately 1,000 feet slope distance inland from mean high tide around all identified estuaries. The beach fringe can be composed of two parts: primary and extended. The primary beach fringe is approximately 500 feet slope distance inland from mean high tide around all coastline, and the extended beach fringe is from approximately 500-1,000 feet slope distance inland from mean high tide around all coastline.

The estuary and primary beach fringes are classified as unsuitable for timber management, and no commercial timber harvest is permitted. The extended beach fringe is suitable for timber production using only eneven-aged management harvest techniques. There are specific standards in the TLMP RSDEIS (1996a) to be followed for harvesting in these areas. Salvage

harvesting is limited to dead and/or down material resulting from catastrophic events (such as windthrow and insect or disease mortality). Limited standing green timber may be harvested during salvage operations for safety and operational considerations. For additional standards and guidelines on estuary and beach fringes, see the TLMP RSDEIS (1996a).

Consumptive Water Uses

There are no congressionally designated municipal watersheds within the Chasina Project Area, but there are a few consumptive water users. The Guildersleeve logging camp in Dora Bay uses surface water as a domestic water supply, as do several float houses and private land owners within the project area. The Forest Service camp in Lancaster Cove uses a groundwater source for water consumption.

Table AQU-5
Stream, Lake, and Estuarine Buffers for Class I and Class II TTRA Streams*

Channel Type	No Commercial Harvest Width (ft.)1/	No Programmed Harvest Width (ft.)2/	Uneven-aged Management Buffer Width (ft.)3/	Planning Level RMA Width (ft.)4/	Site-Potential Tree Height (ft)	Implementation Buffer Width (ft.)5/	Normal Occurrence6/
Alluvial Fan							
AF1	100			100	140	**140**	Y
AF2	100			100	140	**140**	Y
Estuarine							
ES1	100	400		100	140	**500**	Y
ES2	100	100		100	140	**200**	Y
ES3	100	100		100	140	**200**	Y
ES4	100	400		100	140	**500**	Y
ES8	100	400		100	140	**500**	Y
Flood Plain							
FP1	100	100		150	130	**200**	Y
FP2	100	100		150	130	**200**	Y
FP3	100		100	100	130	**200**	Y
FP4	100	100		150	130	**200**	Y
FP5	100	100		150	130	**200**	Y
Highly Contained							
HC1	100			100	120	**120**	N
HC2	100			100	120	**120**	N
HC3	100			100	120	**120**	N
HC4	100			100	120	**120**	N
HC5	100			100	120	**120**	N
HC6	100			100	120	**120**	N
Large Contained							
LC1	100			100	100	**100**	Y
LC2	100			100	100	**100**	Y
Moderate Contained							
MC1	100			100	100	**100**	Y
MC2	100			100	100	**100**	Y
MC3	100			100	100	**100**	Y
Mixed Moderate							
MM1	100			100	120	**120**	Y
MM2	100			150	120	**120**	Y
Plaustrine							
PA1	100	100		100	100	**200**	Y
PA2	100	100		150	100	**200**	Y
PA3	100		400	100	100	**500**	Y
PA4	100		400	100	100	**500**	Y
PA5	100		400	100	100	**500**	Y
Lakes and Ponds							
Lakes >50 acres	100		400	100	100	**500**	Y
Lakes >5 and <50 acres	100		400	100	100	**500**	Y
Lakes <5 acres	100		400	100	100	**500**	Y

1/ No commercial harvest allowed within this zone.
2/ No programmed commercial harvest allowed within this zone.
3/ Only selective harvest or uneven-aged management will be allowed within this zone.
4/ Represents the minimum riparian management area required for consideration under the Forest Plan.
5/ Represents the project specific buffer width that will be used for the Chasina EIS.
6/ Denotes whether this channel type normally occurs in this stream classification.
* Buffer widths reflect horizontal distance extending from one side of the stream channel.

Table AQU-6
Stream, Lake, and Estuarine Buffers for Non-TTRA Class II Streams*

Channel Type	No Commercial Harvest Width (ft.)1/	No Programmed Harvest Width (ft.)2/	Uneven-aged Management Buffer Width (ft.)3/	Planning Level RMA Width (ft.)4/	Site-Potential Tree Height (ft)	Implementation Buffer Width (ft.)5/	Normal Occurrence6/
Alluvial Fan							
AF1	25		35	100	140	**140**	Y
AF2	25		35	100	140	**140**	Y
Estuarine							
ES1				100	140	**140**	N
ES2				100	140	**140**	N
ES3				100	140	**140**	N
ES4				100	140	**140**	N
ES8				100	140	**140**	N
Flood Plain							
FP1	25		35	150	130	**130**	N
FP2	25		35	150	130	**130**	N
FP3	25		35	100	130	**130**	N
FP4	25		35	150	130	**130**	N
FP5	25		35	150	130	**130**	N
Highly Contained							
HC1			100	100	120	**120**	N
HC2			100	100	120	**120**	N
HC3			100	100	120	**120**	N
HC4			100	100	120	**120**	N
HC5			100	100	120	**120**	N
HC6			100	100	120	**120**	N
Large Contained							
LC1		25		100	100	**100**	Y
LC2		25		100	100	**100**	Y
Moderate Contained							
MC1			100	100	100	**100**	Y
MC2			100	100	100	**100**	Y
MC3			100	100	100	**100**	Y
Mixed Moderate							
MM1			25	100	120	**120**	Y
MM2			60	150	120	**120**	Y
Plaustrine							
PA1		100		100	100	**100**	Y
PA2		100		150	100	**100**	Y
PA3			100	100	100	**100**	Y
PA4			100	100	100	**100**	Y
PA5			100	100	100	**100**	Y
Lakes and Ponds							
Lakes >50 acres		100	400	100	100	**500**	Y
Lakes >5 and <50 acres			100	100	100	**100**	Y
Lakes <5 acres				100	100	**100**	Y

1/ No commercial harvest allowed within this zone.
2/ No programmed commercial harvest allowed within this zone.
3/ Only selective harvest or uneven-aged management will be allowed within this zone.
4/ Represents the minimum riparian management area required for consideration under the Forest Plan.
5/ Represents the project specific buffer width that will be used for the Chasina EIS.
6/ Denotes whether this channel type normally occurs in this stream classification.
* Buffer widths reflect horizontal distance extending from one side of the stream channel.

Table AQU-7
Stream, Lake, and Estuarine Buffers for Class III Streams

Channel Type	No Commercial Harvest Width (ft.)1/	No Programmed Harvest Width (ft.)2/	Uneven-aged Management Buffer Width (ft.)3/	Planning Level RMA Width (ft.)4/	Site-Potential Tree Height (ft)	Implementation Buffer Width (ft.)5/	Normal Occurrence6/
Alluvial Fan							
AF1		25		100	140	**25**	Y
AF2		25		100	140	**25**	Y
Estuarine							
ES1				100	140	**0**	N
ES2				100	140	**0**	N
ES3				100	140	**0**	N
ES4				100	140	**0**	N
ES8				100	140	**0**	N
Flood Plain							
FP1		25		150	130	**25**	N
FP2		25		150	130	**25**	N
FP3		25		100	130	**25**	N
FP4		25		150	130	**25**	N
FP5		25		150	130	**25**	N
Highly Contained							
HC1				100	120	**0**	Y
HC2				100	120	**0**	Y
HC3				100	120	**0**	Y
HC4				100	120	**0**	Y
HC5				100	120	**0**	Y
HC6				100	120	**0**	Y
Large Contained							
LC1				100	100	**0**	N
LC2				100	100	**0**	N
Moderate Contained							
MC1				100	100	**0**	N
MC2				100	100	**0**	N
MC3				100	100	**0**	N
Mixed Moderate							
MM1			25	100	120	**25**	N
MM2			25	150	120	**25**	N
Plaustrine							
PA1				100	100	**0**	N
PA2				150	100	**0**	N
PA3				100	100	**0**	N
PA4				100	100	**0**	N
PA5				100	100	**0**	N
Lakes and Ponds							
Lakes >50 acres			100	100	100	**100**	N
Lakes >5 and <50 acres			100	100	100	**100**	N
Lakes <5 acres				100	100	**100**	Y

1/ No commercial harvest allowed within this zone.
2/ No programmed commercial harvest allowed within this zone.
3/ Only selective harvest or uneven-aged management will be allowed within this zone.
4/ Represents the minimum riparian management area required for consideration under the Forest Plan.
5/ Represents the project specific buffer width that will be used for the Chasina EIS.
6/ Denotes whether this channel type normally occurs in this stream classification.
* Buffer widths reflect horizontal distance extending from one side of the stream channel.

Effects of the Alternatives

The objectives of managing aquatic resources in the Chasina Project Area include maintaining fish habitat capability, watershed integrity, large woody debris supply, water quality, water temperature, and fish passage through stream crossing structures. The proposed harvest activities have the potential to impact aquatic resources by altering sources of LWD, streambank stability, water quality (particularly through increased sedimentation), water temperature, and stream flow. This section discusses the potential effects on aquatic resources from implementation of the action alternatives.

Fish Habitat Capability and Water Quality

As previously discussed in this chapter, habitat capability is determined by computer models of the management indicator species (coho and pink salmon and dolly varden char). These species are used because they are believed to best indicate the effects of land management activities. In this case, the models predict a 12.4 percent decrease in coho habitat capability and a 12.5 percent decrease in dolly varden habitat capability in the Chasina Project Area from 1954 to 1994. A continued decrease in habitat capability is expected for another 100 years until the second-growth trees are old enough to start contributing LWD to the stream systems. A decrease in habitat capability may correlate to a decrease in fish populations.

According to the model, habitat capability for pink salmon remains constant from 1954 to 1994. The pink salmon model is not influenced by prescribed logging activities. The model is designed this way because pink salmon smolts migrate to the estuaries directly after emerging from the gravels and are not dependent upon in stream pools created by LWD, as are coho and dolly varden. However, if timber harvesting activities cause sediment deposition in pools, and change channel or substrate composition in the lower reaches of streams where pinks spawn, pink salmon populations could be negatively impacted.

Implementing TTRA buffers should help slow the decreasing trend in habitat capability through time, although these buffers will not eliminate all losses. With increased harvest activities, there is a higher risk of unplanned impacts to aquatic systems. Examples of this are blowdown of buffers, a greater occurrence of landslides, and increased sedimentation from numerous road and stream crossings.

Sedimentation

Many of the sedimentation and erosion problems experienced in areas that have been harvested occur in the vicinity of roads and stream crossings; limited road and stream crossings are of great benefit to aquatic resources. As detailed in the Roads and Facilities Chapter, Alternatives 3, 5, and 6 have the greatest number of stream crossings planned (107, 98, and 151, respectively). These three alternatives have the greatest potential to effect fish habitat and water quality through sedimentation from timber harvest and road construction. Conversely, Alternative 4 has fewer road/stream crossings planned (46 total), and more acres of helicopter logging planned (44.6 percent of the acres to be harvested are by helicopter).

In addition to creating fewer road/stream crossings, which is an important benefit to aquatic resources, helicopter logging usually results in less soil disturbance than cable logging. Cable logging can include some type of log suspension (partial or full) to move the logs to a landing. Disturbance done to the soils is greater when a larger portion of the log is in contact with the ground. Greater disturbance also occurs the longer the log remains in contact with the soils

once it is attached to the cable. The greater the disturbance to soils within a unit, the more likely it is that subsurface waters will channelize; this may increase the probability of landslides. Even if a landslide does not occur, increases in soil disturbance may cause more erosion; greater erosion can effect streams within or below units through increased sedimentation. Since helicopter logging minimizes the amount of contact logs have with the ground, it decreases erosion and sedimentation problems. Helicopter logging generally causes fewer negative impacts to water and soil resources than cable logging, if the helicopter logging is done on lands suitable for harvest.

Water Temperature Sensitivity

In addition to habitat capability, road/stream crossings and sedimentation, another concern in timber harvest areas is temperature sensitive streams. Certain characteristics of some units make them more likely to contribute to the temperature sensitivity of nearby streams. These characteristics include one or more of the following: south-facing slopes, lack of forested buffers, prior harvest activities, shallowness, flow, adjacency to ponds or muskegs, and fish production (FSH 2609.24 Appendix 4). TTRA and AHMU buffers provide sufficient shading for Class I and Class II streams, but Class III and IV streams may not be provided enough shading to prevent increased water temperatures. If Class III and IV streams increase sufficiently in temperature, they could have an adverse temperature impact on downstream fish habitat. Therefore, each unit in the Chasina Project Area was analyzed for the presence of temperature sensitive characteristics, and the potential for each unit to increase water temperature in streams adjacent to or within the unit. Table AQU-8 lists units that may contribute to the temperature sensitivity of nearby streams.

Table AQU-8
Units Having a Potential to Increase Temperature Sensitivity of Nearby Streams

Unit Number	Alternative(s)				
	2	3	4	5	6
678-312		X	X	X	X
678-339					X
679-407			X		X
679-425			X		X
679-437		X	X	X	X

SOURCE: USDA-Forest Service 1996

Cumulative Watershed Impacts

Many watersheds in the Chasina Project Area have already experienced varying amounts of timber harvest. When considering new harvest entries, it is important to consider prior management practices on all lands within a watershed. The large amount of mixed (private,

state, and federal) ownership in the Chasina Project Area complicates management practices on federal lands. Most of the private land within the project area is owned by Kootznoowoo Native Corporation.

As stated earlier in this section, the Chasina Draft EIS used the 1991 TLMP Draft Revision guidelines to analyze cumulative harvest within watersheds; the 1991 TLMP Draft Revision proposed that no more than 35 percent of the land area within a watershed be commercially harvested within a 15 year timespan. Table AQU-9 displays the cumulative harvest in third order and important second order watersheds. Cumulative harvest percentages include harvest activity that has occurred on Kootznoowoo Native Corporation lands. Acreage harvested on Kootznoowoo Native Corporation lands was estimated by using satellite imagary taken in 1995.

As displayed in the table, there are five watersheds in their existing conditions (Alternative 1) that exceed the 35 percent threshold: E94A, H27A, H38A, H54A, and H63A. In each of these watersheds except H38A, additional timber harvest is proposed by at least one of the alternatives (2-6). In addition, watershed H62A is currently 13 percent harvested. Some of the alternatives propose harvest levels in this watershed up to 33 percent, which is very close to the cumulative harvest threshold (35 percent).

Harvesting watersheds in excess of the proposed rate of harvest (35 percent in a 15 year timespan) is risky to the health of the aquatic resources in the watersheds. Increasing rates of harvest before a watershed recovers from prior harvest may have several detrimental results for water quality and fish production. One likely result of this type of disturbance is the reduction in evapotransportation rates (due to tree loss). By decreasing the evapotransportation rate, the amount of water available for streamflow is increased. This would produce higher peak flows and higher volumes of water during storm events, which would impact channel morphology, substrate composition, LWD and pool holding effectiveness (for fish). Another consequence of increased harvest disturbance would be from building more roads and increasing the number of road/stream crossings. These crossings and roads could increase sedimentation levels in the low gradient stream reaches, which would reduce fish spawning and rearing areas. This translates into lower habitat capability and fish populations. A third result of disturbance from increased rates of harvest is the potential to increase the temperature sensitivity of the streams within the watershed. Watersheds are particularly vulnerable to this if there is a large number of unbuffered Class III and IV streams present on south-facing slopes. Increasing summer water temperatures can affect fry emergence from gravels and juvenile migration to sea. High temperatures can also result in adult fish kills.

Table AQU-9
Percent Cumulative Harvest in 3rd Order Watershed and Important 2nd Order Watersheds by Alternative

3rd Order Watersheds	Total Acres	Harvested Ac. Kootznoowoo	Harvested Ac. National Forest	Cumulative Percent Harvest of Watershed by Alternative 1	2	3	4	5	6
E92A	1,861	399	84	26	26	26	28	26	32
E94A	1,313	698	146	64	70	70	64	64	70
H06A	987	0	0	0	0	0	0	0	0
H21A	1,842	0	0	0	0	1	1	7	8
H27A	700	426	0	61	61	61	61	61	63
H28A	1,849	0	147	8	8	8	8	8	9
H30A	78	0	0	0	0	0	3	3	3
H38A	459	218	1	48	48	48	48	48	48
H42A	1,909	255	0	13	13	13	13	13	15
H54A	2,780	1,403	57	53	54	54	54	54	54
H62A	867	2	113	13	26	29	33	29	33
H63A	842	2	322	39	48	48	56	48	56
2nd Order Watersheds									
H05A	1,184	0	5	1	1	1	2	2	2
H49A	734	0	8	1	1	1	13	4	18
H50A	705	0	107	15	15	15	18	18	18
H59A	970	0	82	8	25	15	24	21	26

Mitigation

There are several mitigation measures in place for the protection of aquatic resources. The intent of using mitigation measures is to provide for other land management uses while taking into account aquatic resource management objectives. Region 10 best management practices (BMPs) should be applied to all management activities near or adjacent to streams, lakes, beaches, estuaries, and riparian management areas.

Harvest Units

Within harvest units, the most common mitigation measures are stream and lake buffers for Class I and II systems, and specified logging techniques for Class III and IV systems; sometimes Class III streams receive buffers too. For Class I and II TTRA streams, there are 100-foot minimum no cut buffers to limit direct damage to fish systems. The only harvest allowed within a TTRA buffer is incidental right-of-way clearing for road/stream crossings and skyline corridors (see Roads and Facilities section for details). Refer to Tables AQU-5 through 7 for specific buffers by class and channel type. During logging, trees are directional felled and split yarded away from Class III streams, or the logs are fully suspended above the stream while yarding them to the landing. Examples of other management options for Class III streams that need greater protection, such as V-notches, include slope-break buffers and diameter (size-limit) cuts. Any logging debris falling into a Class III stream must be cleaned out immediately after being placed into the system. Class IV streams require directional felling, and split yarding (where practical) or partial suspension. Any logging debris introduced to the system must be cleaned out either before the yarder leaves the area or by the end of the operating season.

Roads and Stream Crossings

The choice of road/stream crossing locations are critical in terms of both fish passage and sedimentation effects. Stream reaches with uniform alignment, good bank stability, and uniform gentle gradients are the easiest to cross with provisions for fish passage. Guidelines in the AHMU Handbook recommend that fish passage be provided on all streams with natural gradients of 4 percent or less, using typical designs for bridges and culverts installed at a grade of 1 percent or less. Streams with gradients greater than 4 percent will be evaluated by a Fisheries Biologist on a site-specific basis.

Some mitigation recommendations for design and maintenance of the road system to maintain riparian and wetland function, and fish habitat include the following:

1. Construction of roads in sediment source areas should be avoided. Roads in these sensitive areas have the potential to accelerate large scale mass wasting. When mass wasting occurs, there is a high probability for direct sediment delivery to anadromous and resident fish habitats.

2. Remove all drainage structures in sensitive areas where fish passage, beaver presence, and unstable stream channels are a concern, unless routine road drainage maintenance is feasible. Close all temporary roads and use water bars to control road drainage. Where culverts are pulled on closed roads, the road bed should be sloped back away from the stream to a naturally stable slope.

3. Avoid crossing active alluvial fan channel areas. When possible, locate crossings at the apex of the fan; the stream is still relatively contained at the apex. If the fan must be crossed, oversized and extra drainage structures should be installed.

4. Avoid or minimize the amount of new road construction through fens. Roads located on fens can impede natural water movement associated with those areas. In order to prevent the impedance of the water, road construction requires a large amount of drainage structures. Fens often contain numerous Class I and II channels, which require special

passage and/or timing restrictions. Roads constructed across fens usually require high maintenance due to beaver activity.

For additional mitigation measures regarding road/stream crossings, see the Roads and Facilities Section in this document, the TLMP RSDEIS (1996a), and Region 10 BMPs.

In Stream Construction Timing

Seasonal timing for in stream construction operations are required by ADF&G for Class I streams. Timing may be recommended for Class II streams and sometimes Class III streams. Timing recommendations are based on the site-specific and downstream impacts to spawning, egg presence, fry emergence, and migration of smolts (BMP 14.64). The general windows represent the period of time in stream work may be conducted. The general windows are:

Pink/Chum	June 1 - August 7
Coho	June 15 - September 1
Steelhead/Sockeye	July 18 - August 15

Variances from the general timing windows are allowed, and final timing windows are determined by a Fisheries Biologist after a site review and with stream specific information.

Watersheds

The most informed way to minimize cumulative watershed impacts is to conduct some level of watershed analysis prior to management activities (i.e., timber harvest and road building). Once the amount of disturbance a watershed can recover from is known, an acceptable rate of harvest can be determined. In those watersheds that are more sensitive to disturbance, the rate and amount of timber harvested and roads built should be reduced or even not entered. If logging is going to occur in sensitive watersheds, helicopter logging should be strongly considered in place of traditional cable logging operations.

Table AQU-12 displays the cumulative harvest in third order watershed and important second order watershed include harvest activity that has occurred on Kootznoowoo Native Corporation lands. The amount harvested on Kootznoowoo Native Corporation lands was estimated by using satellite imagery taken in August 1995 of the project area. Many watersheds have been harvested in excess of 35 percent.

Floodplains

Key Terms

Best Management Practices (BMPs)—methods, measures, or practices to prevent or reduce water pollution, including, but not limited to, structural and non-structural controls, operation and maintenance procedures, other requirements, and scheduling and distribution of activities. These are primary control mechanisms for non-point sources of pollution on National Forest System lands. Control of non-point source pollution is required by the Clean Water Act. BMPs must be consistent with State regulations. (USDA FSH 2509.22, 1993)
Floodplains—lands adjacent to stream or river channels that are covered with water when the stream or river overflows its banks at flood stages. Well-drained soils develop on these lands and support vegetation.
Riparian Area—the area including a stream channel, lake, or estuary bed, the water itself, and the plants that grow in the water and on the land next to the water.
Soil—technical term for what is commonly referred to as dirt. Soil is made up of both mineral and organic materials that cover much of the earth's surface. It contains living matter and it generally supports the growth of vegetation (Soil Survey Staff 1992). Each type of soil has specific properties that differ from other soils. Each type of soil is given a name.
Value Comparison Units (VCU)—area generally encompassing a drainage basin containing one or more large stream systems. Boundaries usually follow watershed divides.

Affected Environment

A floodplain is the valley floor inundated by a river or stream during high water periods. Naturally-eroded sediments carried by the floodwaters are deposited in slack water reaches of the floodplain, where they accumulate to form nutrient-rich soils. Floodplains are among the most productive sites found on the Tongass National Forest for timber, wildlife, and fisheries. Changes to the rate or quantity of sediment deposition within the floodplain have the potential to affect these resources.

Federal agencies are directed by Executive Order 11988 to provide leadership and take action on Federal lands to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains. Under the TLMP Draft Revision (1991a), floodplains are managed through implementation of Riparian standards and guidelines for protection of riparian areas. For management purposes, floodplains are defined as the area subject to a 1 percent (100-year recurrence) or greater chance of flooding in any given year.

Values for floodplains in this section are based only on the portion of the project area on National Forest System lands, and the portion of these National Forest System lands on which the soil inventory was conducted. This inventory and the portion of the project area it covers are discussed in the soils section in Chapter 3 of this document.

The area estimated to be affected by roads is averaged as 37.5 feet on each side of the road center line, 75 feet total width, and 9.1 acres per mile. This figure includes rock pits, landings, turnouts, and areas where endhaul material is deposited. The 9.1 acres of disturbance per mile of road in these tables is believed to overestimate the lands affected by roads because the 75 feet is the clearing width; plus, overlay construction techniques will disturb less soil beneath the road surface. Still, the acreage figures are valid for making comparisons.

Within the Chasina Project Area, several streams support well developed floodplains (Table FP-1). There are 839 acres of floodplain soils identified on the project area. All of these acres of floodplain soils are on National Forest System lands.

Table FP-1
Acres of Floodplain Soils on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Stream Name or Location/ADF&G #	Watershed Number	Acres
674	Cannery Creek/102-40-10520	H21A	149
677			0
678	South Arm West/102-40-10470	H05A	24
	South Arm West/No Number	H05A	32
	South Arm East/102-40-10430	H06A	25
	South Arm Center/No Number	H28A	130
	South Arm Center/No Number	EV1A	22
679	Kitkun Bay/102-40-10170	H50A	54
	Horseshoe Canyon/102-40-10150	H59A	136
	Chasina Point/102-50-10150	F48A	24
680	Dolomi East/102-50-10100	E94A	9
681	Dolomi South/No Number	FB7A	25
	Dutch Harbor/102-50-10070	H54A	29
	French Harbor/102-50-10050	H55A	7
	Paul Lake/No Number	H56A	6
	Paul Lake West/ No Number	H56A	129
682	Nowiskay Cove/102-30-10910	H49A	39
	Moira West/102-30-10950	H79A	30
	Moira Center/ No Number	H78A	10
	Moira East/No Number	FH1A	9
Total			**889**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Previous timber harvest and road-building activity have occurred on floodplain soils in the project area. A total of 123 acres have been harvested (Table FP-2). VCUs 678 and 679 show the highest degree of harvest. Twelve acres of floodplain soils are roaded, based on an average road clearing width of 75 feet (Table FP-3). VCU 679 is the only VCU currently roaded on National Forest System lands on the project area. Stream channels within floodplains are currently spanned by five road crossings (Table FP-4).

Table FP-2
Acres Harvested and Projected Harvest on Floodplain Soils on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Currently	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	2040
674	0	0	0	0	6.6	66	0
677	0	0	0	0	0	0	0
678	73.7	0	0	0	0	0	15.5
679	40.7	16.1	16.1	2.5	0	16.1	128.7
680	7.8	0	0	0	0	0	0.2
681	0.5	0	0	0	0	0	62.0
682	0.6	0	0.4	0.4	0	3.8	0
Total	**123.3**	**16.1**	**16.5**	**2.9**	**6.6**	**26.5**	**206.4**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table FP-3
Acres Roaded and Projected Roading on Floodplain Soils on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Currently	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	2040
674	0	0	0	0	0	0	0
677	0	0	0	0	0	0	0
678	0	0	0	0	0	0	2.3
679	12.2	0	0	0	0	0	19.3
680	0	0	0	0	0	0	< 0.1
681	0	0	0	0	0	0	9.3
682	0	0	0	0	0	0	0
Total	**12.2**	**0**	**0**	**0**	**0**	**0**	**30.9**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table FP-4
Number of Stream Crossings and Projected Crossings on Floodplain Soils on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Currently	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	2040
674	0	0	0	0	0	0	0
677	0	0	0	0	0	0	0
678	0	0	0	0	0	0	0
679	5	0	0	0	0	0	5
680	0	0	0	0	0	0	0
681	0	0	0	0	0	0	0
682	0	0	0	0	0	0	0
Total	**5**	**0**	**0**	**0**	**0**	**0**	**5**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Effects of the Alternatives

Direct and Indirect Effects

Executive Order 11988 requires agencies to: (1) avoid direct or indirect support of floodplain development actions whenever there are practicable alternatives, (2) evaluate the potential effects of proposed action on floodplains, (3) ensure that planning programs and budget requests consider flood hazards and floodplain management, and (4) prescribe procedures to implement the policies and requirements of the Executive Order.

Tables FP-2 to FP-4 estimate the acres of floodplain soils to be affected by timber harvest and road construction under each of the proposed alternatives. Between 3 acres (Alternative 4) and 26 acres (Alternative 6) are proposed for harvest on floodplains under the action alternatives. No additional road construction is proposed within floodplains under action alternatives. No new road crossings of streams within floodplains are proposed by implementation of the action alternatives. Stream crossings include the main stream and tributary streams flowing into it.

During road construction, both direct and indirect disturbance of floodplains may occur. Modification of channels and streamflows, either locally or upstream of the floodplain, has the potential to alter floodplain hydrology, resulting in different erosion and sediment transport characteristics.

BMPs will be used to minimize impacts on floodplains and related resources including fisheries, wetlands, and riparian areas. The Unit and Road Cards in Appendix J present the BMPs assigned as a result of site-specific field inventory or office review. The BMPs are described in more detail in Appendix F.

Cumulative Effects

Tables FP-5 and FP-6 estimate cumulative effects of past, proposed under this project, and potential future timber harvest on floodplain soils. VCU 678 would have the greatest acreage affected by timber harvest under all alternatives because it has the largest acreage currently affected (Table FP-5). It is projected VCU 679 would have the largest acreage affected by timber harvest in 2040. VCU 679 is the only area currently affected by roads, but will not have additional roading on floodplains under any of the action alternatives (Table FP-6). It is projected VCU 679 would still have the largest acreage on floodplains affected by roads in 2040.

Table FP-5
Projected Cumulative Acres Harvested on Floodplain Soils on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Currently	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	2040*
674	0	0	0	0	6.6	6.6	0
677	0	0	0	0	0	0	0
678	73.7	73.7	73.7	73.7	73.7	73.7	89.2
679	40.7	56.8	56.8	43.2	40.7	56.8	185.5
680	7.8	7.8	7.8	7.8	7.8	7.8	8.0
681	0.5	0.5	0.5	0.5	0.5	0.5	62.5
682	0.6	0.6	1.0	1.0	0	4.4	1.0
Total	**123.3**	**139.4**	**139.8**	**126.2**	**122.7**	**143.2**	**346.2**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

* Uses Alternative 3.

Table FP-6
Projected Cumulative Acres Roaded on Floodplain Soils on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Currently	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	2040*
674	0	0	0	0	0	0	0
677	0	0	0	0	0	0	0
678	0	0	0	0	0	0	2.3
679	12.2	12.2	12.2	12.2	12.2	12.2	31.5
680	0	0	0	0	0	0	< 0.1
681	0	0	0	0	0	0	9.3
682	0	0	0	0	0	0	0
Total	**12.2**	**12.2**	**12.2**	**12.2**	**12.2**	**12.2**	**43.1**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

* Uses Alternative 3.

Mitigation Measures

Floodplains should not be harvested because they are part of the riparian buffer on streams and are eliminated during field review of proposed units. Road systems, however, will cross floodplains. To minimize adverse effects, the frequent placement of culverts and bridges is indicated on the road Cards (Appendix J). These culverts and bridges prevent the road prism from inhibiting the flow of floodwaters. (EPA 1993, cited in Foster Wheeler 1995.)

Monitoring

The Forest Plan recognizes three distinct types of monitoring: implementation, effectiveness, and validation. Implementation monitoring determines if projects and activities comply with Forest Plan Standards and Guidelines. Effectiveness monitoring determines whether the standards and guidelines achieve the desired results. Validation monitoring determines whether the assumptions in the Forest Plan regarding the relationship between management actions and their effects are correct, or if there is a better way to depict these relationships.

A monitoring plan has been developed for the Tongass National Forest by the Forest Planning Team and is described in the TLMP Draft Revision (1991a). The Forest Plan contains no specific monitoring goals for floodplains. Monitoring for this resource generally is covered by the soils and water monitoring BMPs. In accordance with the 1992 Memorandum of Agreement between the Alaska Department of Environmental Conservation and the USDA-Forest Service Alaska Region, the Forest Service performs annual BMP implementation and effectiveness monitoring. The Chasina Project Area will be part of the Forest Plan monitoring and the Ketchikan Area Monitoring Strategy.

Project-specific monitoring that is unique to the Chasina Project Area, and that would not be included in regular Forest Plan or routine implementation monitoring, has been identified for several resources. Project-specific monitoring is not planned for floodplain resources on the Chasina Project Area.

Riparian Management Areas

Key Terms

Best Management Practices (BMPs)—methods, measures, or practices to prevent or reduce water pollution, including, but not limited to structural and non-structural controls, operation and maintenance procedures, other requirements, and scheduling and distribution of activities. These are primary control mechanisms for non-point sources of pollution on National Forest System lands. Control of non-point source pollution is required by the Clean Water Act. BMPs must be consistent with State regulations. (USDA FSH 2509.22, 1993)

Floodplains—lands adjacent to stream or river channels that are covered with water when the stream or river overflows its banks at flood stages. Well-drained soils develop on these lands and support vegetation.

Muskeg (peatlands)—plant communities and soils that have developed in depressions or on relatively flat areas, are poorly drained, have organic soils, and support vegetation that is predominantly sphagnum mosses (bogs) or sedges (fens), with forbs and lesser amounts of shrubs and stunted trees.

Riparian Area—the area including a stream channel, lake, or estuary bed, the water itself and the plants that grow in the water and on the land next to the water.

Riparian Management Area (RMA)—the area, including water, land, and plants, that is at least 100 slope feet away from each side of perennial streams, lakes, and other bodies of freshwater.

Wetlands—areas inundated by surface or groundwater with a frequency or duration sufficient to support a prevalence of vegetation typically adapted to life in saturated soils conditions. Classification of wetlands is based on soil, vegetation, and hydrology factors. Wetlands in Southeast Alaska include muskegs, estuaries, and forested wetlands.

Affected Environment

Riparian Management Areas

Riparian areas are aquatic habits such as lakes, streams, and estuaries, and the lands adjacent to them. The aquatic and terrestrial elements of a riparian area typically are closely related and interdependent. For example, soil saturation and composition influences the plant species found adjacent to the water body, while plant species composition influences stream shading, water temperature, and bank stability. Riparian areas, particularly on low elevation floodplain sites, are highly production environments for fish, timber, and wildlife resources. Forested riparian areas often serve as travel corridors for deer between low elevation winter range and higher elevation summer range.

The National Forest Management Act (NFMA) requires that riparian areas be established to protect water quality and fisheries habitat. The Tongass Timber Reform Act (1990) specifies

protection requirements for salmon-bearing streams. The TLMP Draft Revision (1991a) provides for protection of riparian-related resources under the Riparian Standards and Guidelines.

Under the Riparian Standards and Guidelines, administrative riparian management areas (RMAs) are defined based on stream channel type and adjacent soils. RMAs include perennial streams, bodies of water with actively flowing freshwater, bodies of freshwater inhabited by fish, and estuaries, along with the lands adjacent to these aquatic habitats. The adjacent lands are those dominated by riparian vegetation and those adjacent non-riparian lands with potential to influence water quality. A minimum of 100 feet (horizontal distance) on each side of the water body is included within the riparian management area.

The RMA is comprised of four primary components, each with different management requirements.

1. No Commercial Harvest Buffer—a minimum 100-foot buffer is applied to either side of all Class I streams and Class II streams that flow directly into Class I streams, as specified in the Tongass Timber Reform Act (1990). No commercial harvest is allowed within the buffer, although limited clearing for road building is permitted.

2. No Programmed Harvest Buffer—this is applied primarily to alluvial fan, floodplain, and estuary channel types, and is additional to the no-commercial harvest buffer, if the latter is present. Programmed harvest activities are precluded within this buffer, but salvage and individual tree cutting may occur.

3. Selective Harvest Buffer—a selective harvest buffer is designated on several channel types, including some of the alluvial fan and floodplain process groups, and many lakes. Within this buffer, selective harvest of trees is allowable in accordance with specific direction provided in the Riparian Standards and Guidelines. The Selective Harvest Buffer is additional to any No Commercial or No Programmed Harvest buffers present on a stream reach.

4. Planning Level Zone—all channel types not receiving at least one of the first three buffer components are included in the planning level zone (minimum 100-foot width). The area within this zone is available for harvest while meeting RMA objectives for fish habitat and water quality, as specified in the Riparian Standards and Guidelines. All channel types on National Forest System lands fall within the first three components of RMAs on this project.

Each of the four RMA components is extended to include adjacent floodplains or high mass movement soils. (For detailed discussion of these soil types, refer to the Soils and Floodplains sections in Chapter 3.)

Appendix C presents the minimum RMA component widths for all channel types in the Chasina Project Area. These widths are applied to each side of a stream channel. In addition, lakes larger than 50 acres receive a 100-foot no-harvest buffer plus a 400-foot selective harvest buffer. Lakes less than 50 acres, but greater than five acres, receive 100-foot no-harvest buffers. Lakes less than five acres are managed under the 100-foot planning level zone. Each of the four components may be extended beyond these minimum widths to

include adjacent riparian or high mass movement soils, and as directed by site-specific inventories of riparian conditions. Channel types are described in the Channel Types User Guide (USDA-Forest Service 1992b, cited in Harza 1995).

A total of 2,308 acres are located within RMAs on National Forest System lands on the Chasina Project Area (Table RMA-1). Important RMAs coincide with the floodplain areas noted in the floodplain section (Chapter 3), and also include the margins of large lakes and wetlands. Table RMA-1 indicates the acres of old growth and second growth within each of the four RMA components.

Table RMA-1
Acres Within RMA Components, by Vegetation Type on National Forest System Lands on the Chasina Project Area

RMA Component	Total RMA	Old Growth	Second Growth
No Commercial Harvest Buffer	1,778	1,621	157
No Programmed Harvest Buffer	8	6	2
Selective Harvest Buffer	522	428	94
Planning Level Zone	0	0	0
Total All Components	**2,308**	**2,055**	**253**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

There are approximately 2,595 acres of existing timber harvest on National Forest System lands on the project area (Table SOILS-12). Approximately 253 acres lie within RMA components (Table RMA-2). It is noted that the acreage in no commercial harvest buffers was harvested prior to passage of the TTRA of 1990. The acreage in no programmed harvest buffers and selective harvest buffers was harvested prior to current standards and guidelines that now prohibit harvest in these buffers.

Table RMA-2
Acres of RMAs Affected by Timber Harvest on National Forest System Lands on the Chasina Project Area

RMA Component	Existing	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	2040
No Commercial Harvest Buffer	157	76	164	171	191	322	1,621
No Programmed Harvest Buffer	2	0	1	0	1	1	6
Selective Harvest Buffer	94	8	13	10	12	21	428
Planning Level Zone	0	0	0	0	0	0	0
Total All Components	**253**	**84**	**178**	**181**	**204**	**344**	**2,055**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

There are approximately 16 miles (144 acres) of roads on National Forest System lands on the Chasina Project Area (Tables SOILS-11 and SOILS-13). Approximately 17 acres lie within RMA components (Table RMA-3). Again, it is noted that these areas were roaded prior to establishment of current standards and guidelines.

Table RMA-3
Acres of RMAs Affected by Road Construction* on National Forest System Lands on the Chasina Project Area

RMA Component	Existing	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	2040
No Commercial Harvest Buffer	10	15	31	24	29	51	243
No Programmed Harvest Buffer	0	0	0	0	0	0	1
Selective Harvest Buffer	7	1	3	2	2	4	64
Planning Level Zone	0	0	0	0	0	0	0
Total All Components	**17**	**16**	**34**	**26**	**31**	**55**	**308**

SOURCE: USDA-Forest Service, Ketchikan Area Data Base 1996.

* Includes proposed roads and existing roads to be reconstructed. Assumes area disturbed from roads, landings, turnouts, endhaul areas, and rock pits is averaged to a road width of 75 feet, for 9.1 acres per mile of road.

Effects of The Alternatives

Direct and Indirect Effects

Riparian areas may be affected directly, through harvest and road construction, or indirectly through changes in hydrology, sediment transport, water temperature, or windthrow. Protection of riparian areas is provided by their designation with the implementation of Forest-wide standards and guidelines for riparian areas, and BMPs for both timber harvest and road construction. For a description of BMPs, see Appendix F.

Table RMA-2 estimates acres to be affected within RMA components by harvest units under this project. Harvest is not proposed for the no commercial harvest buffers (TTRA), nor the no programmed harvest buffers. The values for these components in the table represent potential impact to these buffers based on GIS analysis. Units have been corrected during field review to avoid these buffers. Ranking the action alternatives from greatest to least impact to the remaining selective harvest buffers is: 6 greater than 3 slightly greater than 5 slightly greater than 4 slightly greater than 2. Acreage varies from 21 to 8 for these alternatives.

Table RMA-3 estimates acres to be affected within RMA components by roads under this project. Ranking the action alternatives from greatest to least impact to the RMA components follows that for harvest units: 6 greater than 3 slightly greater than 5 slightly greater than 4 greater than 2 (Table RMA-3). Acreage varies from 55 to 16 for these alternatives.

BMPs should be implemented during timber harvest and construction of roads for protection of fisheries habitat and water quality. The unit and road cards in Appendix J include BMPs recommended based on site and office review.

Cumulative Effects

Cumulative impacts to RMA components are estimated following completion of this project (2004), and to the foreseeable future, 2040. Again, harvest is not proposed for the no commercial harvest buffers (TTRA), nor the no programmed harvest buffers, although some road construction will occur within these buffers. The values for these components in the table include potential impact to these buffers from harvest units, and probable impact from roads based on GIS analysis. Units have been corrected during field review for this project to avoid these buffers, and it is assumed this will also be done for future harvest. In addition, implementation of the standards and guidelines of the TLMP Draft Revision (1991a) ensures maintenance of cumulative harvest standards for high gradient contained stream channel types. Values for 2004 include currently affected acreage and Alternative 3 of this project. Values for 2040 include currently affected acreage and all additional lands identified as suitable and available for timber harvest under the TLMP Draft Revision (1991a).

Table RMA-4
Cumulative Acres of Timber Harvest and Road Construction on National Forest System Lands on the Chasina Project Area

RMA Component	Total Area	1954	2004*	2040**
No Commercial Harvest Buffer	1,778	0	362	2,031
No Programmed Harvest Buffer	8	0	3	9
Selective Harvest Buffer	522	0	117	593
Planning Level Zone	0	0	0	0
Total All Components	**2,308**	**0**	**482**	**2,633**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

* Uses Alternative 3 of Chasina Project and existing affected acreage.

** Uses existing, and suitable and available per TLMP 1991. Not corrected for acres of roads removed from timber base.

Mitigation Measures

Mitigation measures designed to protect riparian areas are based on TLMP Draft Revision Standards and Guidelines (1991a), the RMA definition, the associated planning level buffer prescriptions (Appendix C), and the site-specific buffers prescribed in the field. The prescription of buffers in the field is the most important mitigation measure because it ensures the location and evaluation of all streams in the harvest units. This field verification identified all Class I streams and Class II streams and prescribed the appropriate buffer. This procedure allows the avoidance of the riparian area adjacent to any previously unknown Class I and Class II streams. Additionally, field verification allowed the identification of numerous previously unmapped Class III streams and prescribed directional falling and split yarding of trees away from the stream. In some cases, buffers were prescribed for Class III streams because of the presence of unstable soils along steep V-notches that could contribute sediment to the stream. The unit cards identify mitigation measures applied to harvest units (Appendix J).

Buffers on streams are susceptible to blowdown after harvest. Prevention and minimization of blowdown was developed using techniques described in the Southeast Alaska Guide for Reducing Wind Damage (Harris 1989, cited in Foster Wheeler 1995). The applied techniques use unit boundaries and harvest types, which incorporate partial retention around the unit perimeter to reduce risk. The Ketchikan Area is currently monitoring blowdown in stream buffers to determine the effectiveness of the buffers and other techniques (USDA-Forest Service 1992f, cited in Foster Wheeler 1995). One function of no-harvest buffers on Class I streams is to maintain the supply of large woody debris to the stream. Windthrow is the most common source of natural large woody debris loading. Consequently, the blowdown of portions of buffer strips merely changes the timing of debris input (Gregory and Ashkenas undated, cited in Foster Wheeler 1995). Catastrophic blowdown of long lengths of buffer on Class I streams could reduce long-term input of LWD. Catastrophic blowdown creates a

detrimental condition, e.g., barriers to anadromous fish. Because of this, modification of the debris accumulation should be considered on a case-by-case basis.

For Class I and Class II streams, most of the buffers applied are for one side of the stream. For the most part, planned timber harvest units utilized Class I and Class II streams as unit boundaries rather than including them within the harvest units. Class III streams may also serve as unit boundaries, but may be inside units also.

RMAs are based on the "Riparian Management Requirement" in the January 18, 1989, letter by the three forest supervisors on the Tongass National Forest, and R10 Supplement No. 2500-91-1 to FSM 2500, 1991. This policy was established to meet the riparian areas requirement in the Tongass Land and Resource Management Plan Revision in effect at that time (TLMP 1991a).

This management area is not an area of exclusion of management activities. Some lands defined in this management zone can still be harvested and affected by road construction. Lands within the management area have a high risk of affecting water resources.

These management zones may be redefined in the final document because figures for land affected in this document suggest harm where none is being done. One example is Class III and Class IV streams where harvest is allowed under standards and guidelines, but is given a 100-foot buffer by definition of this management area. Another example is that RMAs include MMI4 soils when they lie adjacent to stream buffers prescribed by the riparian management description. These soils may not affect the streams if adjacent lands are harvested or roaded. An example of this is along North Arm of Moira Sound where an extensive area of MMI4 soil touches only a small portion of the proposed 100-foot buffer on a Class III stream.

Monitoring

The Forest Plan recognizes three distinct types of monitoring: implementation, effectiveness, and validation. Implementation monitoring determines if projects and activities comply with Forest Plan Standards and Guidelines. Effectiveness monitoring determines whether the standards and guidelines achieve the desired results. Validation monitoring determines whether the assumptions in the Forest Plan regarding the relationship between management actions and their effects are correct, or if there is a better way to depict these relationships.

A monitoring plan has been developed for the Tongass National Forest by the Forest Planning Team and is described in the TLMP Draft Revision (1991a). The Forest Plan contains no specific monitoring goals for RMAs. Monitoring for this resource is generally covered by the soils and water monitoring BMPs. In accordance with the 1992 Memorandum of Agreement between the Alaska Department of Environmental Conservation and the USDA-Forest Service Alaska Region, the Forest Service performs annual BMP implementation and effectiveness monitoring. The Chasina Project Area will be part of the Forest Plan monitoring and the Ketchikan Area Monitoring Strategy.

Project-specific monitoring that is unique to the Chasina Project Area, and that would not be included in regular Forest Plan or routine implementation monitoring, has been identified for several resources. Project-specific monitoring is not planned for RMA resources in the Chasina Project Area.

Wetlands

Key Terms

Best Management Practices (BMPs)—methods, measures, or practices to prevent or reduce water pollution, including, but not limited to, structural and non-structural controls, operation and maintenance procedures, other requirements, and scheduling and distribution of activities. These are primary control mechanisms for non-point sources of pollution on National Forest Service lands. Control of non-point source pollution is required by the Clean Water Act. BMPs must be consistent with State regulations. (USDA FSH 2509.22, 1993)

Estuarine Wetland System—deep water tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land, have open, partly obstructed or sporadic access to the open ocean, and in which ocean water is of at least occasionally diluted by freshwater runoff from the land. Predominantly intertidal areas where fresh water lakes and streams connect with the open sea.

Lacustrine Wetland System—includes permanently flooded lakes and reservoirs, intermittent lakes, and tidal lakes with ocean-derived salinities of less than 0.5 percent. Typically, there are extensive areas of deep water and there is considerable wave action.

Muskeg (peatlands)—plant communities and soils that have developed in depressions or on relatively flat areas, are poorly drained, have organic soils, and support vegetation that is predominantly sphagnum mosses (bogs) or sedges (fens), with forbs and lesser amounts of shrubs and stunted trees.

Palustrine Wetland System—vegetated wetlands including muskegs, scrub-shrub, and forest.

Riparian area—the area including a stream channel, lake or estuary bed, the water itself, and the plants that grow in the water and on the land next to the water.

Riverine Wetland System—a category in wetland classification which includes all wetlands and deep water habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens; and (2) habitats with water containing ocean-derived salts in excess of 0.5 percent. Includes all channel-contained streams.

Soil—technical term for what is commonly referred to as dirt. Soil is made up of both mineral and organic materials that cover much of the earth's surface. It contains living matter and it generally supports the growth of vegetation (Soil Survey Staff 1992). Each type of soil has specific properties that differ from other soils. Each type of soil is given a name.

Soil drainage—rate of movement of water through the soil and time water is contained in the soil.

Soil map unit (SMU)—collection of areas defined and named the same in terms of their soil components, or miscellaneous areas, or both. Each map unit consists of one or more components. (Soil Survey Division Staff 1993.)
Soil productivity—capacity of a soil to produce plant growth. Related to inherent chemical, physical, and biological properties of soil.
Value Comparison Unit (VCU)—area generally encompassing a drainage basin containing one or more large stream systems. Boundaries usually follow watershed divides.
Wetlands—areas that are inundated by surface or groundwater with a frequency or duration sufficient to support a prevalence of vegetation typically adapted to life in saturated soil conditions. Classification of wetlands is based on soil, vegetation, and hydrology factors. Wetlands in Southeast Alaska include muskegs, estuaries, and forested wetlands.

Affected Environment

Introduction

Wetlands are defined as "those areas that are inundated or saturated by surface or groundwater with a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (40 CFR 230.41(a)(1)). The high precipitation level and glacial terrain of Southeast Alaska have combined to form extensive wetland complexes, including muskegs, estuaries, and forested wetlands.

Executive Order 11990, as amended, requires Federal agencies to avoid to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands. The TLMP Draft Revision (1991a) includes Forest-wide standards and guidelines directed at minimizing the loss of wetland acreage and enhancing the values and functions of existing wetlands.

The U.S. Army Corps of Engineers (COE) Wetlands Delineation Manual (1987) provides the standard for determining a site's wetland status. In addition, DeMeo and Loggy (1989) have developed wetland identification procedures specific to Southeast Alaska's vegetation communities. Under the COE manual (1987), sites are considered wetlands when they meet criteria regarding soil, hydrology, and vegetation. Generally, wetlands are lands where soils are wet often enough that vegetation which can grow and survive on wet soil prevails on the site. The DeMeo and Loggy (1989) procedure, used to classify wetlands on the Ketchikan Area, evaluates the vegetation and soil layers in the GIS data base and then assumes the presence of the wetland hydrological criteria. In addition, their procedure calculates wetland acreages based on the general percentage of the vegetation and soil types within soil map units (SMUs). Consequently, the DeMeo and Loggy procedure generates a maximum acreage of potential wetlands rather than a wetland delineation and associated acreage.

Wetland GIS analysis in this section is based only on the portion of the project area on National Forest System lands, and the portion of these lands on which the soil inventory was conducted. This inventory and the portion of the project area it covers are discussed in the Soils section of Chapter 3 in this EIS.

Approximately 19,609 acres, or 48 percent, of the inventoried National Forest System lands on the Chasina Project Area are wetlands under the classification system in Table WETL-1. These include wetlands of the palustrine system (open muskegs, freshwater sedge meadows, forested muskegs, and other forested wetlands), estuarine system (emergent sedge and intertidal/subtidal mudflats), lacustrine system (lakes and ponds), and riverine system (streams). The TLMP Draft Revision (1991a; pages 3-423 and 3-424) provides detailed descriptions of the wetland systems and classes. Table WETL-1 presents the acres within each wetland system and class found on the project area. Lucustrine and riverine systems do not generally have the vegetation component needed per the definition to be classified as wetlands.

Table WETL-1
Acres of Wetlands* on Inventoried National Forest System Lands on the Chasina Project Area

Wetland System	Wetland Class	Acres
Palustrine	Forested (Mineral)	8,182
	Forested (Organic)	5,926
	Open Muskeg (Organic)	3,600
	Open Muskeg (Mineral)	206
Estuarine		11
Lacustrine (Lakes)		830
Riverine (Rivers and Streams)		854
Total		**19,609**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

* Many of the wetlands in the project area occur in complexes with nonwetlands or other wetland types. A complex is an area of two or more dissimilar vegetation and soil types occurring in a regularly repeating pattern that can be mapped on aerial photographs. Values for this table were derived using percent composition of each vegetation and soil type of the complexes. These percentages were determined during the soil and vegetation survey.

Wetland Systems and Classes

Forest wetlands are the most prevalent wetland class on inventoried National Forest System lands on the project area. Forested wetlands occur on 14,108 acres (Table WETL-1). The greatest acreage, 8,182, is on mineral soil. These mineral wetland soils vary from somewhat poorly to poorly drained. Forested wetlands on organic soils occur on 5,926 acres. Drainage

on these organic soils varies from poorly to very poorly drained. Plant associations (USDA 1992j) range from western hemlock to shore pine as drainage on wetland soils declines. Timber on the better drained sites is commonly Volume Class 5 or 4. Poorer drained sites are non-commercial timber, Volume Class 3. Small open muskegs may be interspersed with forested wetlands, particularly on the poorer drained organic soils. VCU 679 has the greatest amount of forested wetlands (Tables WETL-2 and WETL-3). This includes those on both mineral and organic soils.

Open muskegs occur on 3,806 acres of inventoried National Forest System lands on the project area. These wetlands are found from low to high elevations. They are dominated by sphagnum moss or sedges and interspersed with forbs, shrubs, and stunted trees. VCU 679 has the greatest acreage of muskeg (Tables WETL-2 and WETL-3).

Estuaries are unique ecosystems located at the interface of freshwater, terrestrial, and marine environments. Estuaries support marine invertebrates such as clams and crabs, saltwater fish, and anadromous fish. These species, in turn, support a wide variety of wildlife, including waterfowl, wading birds, bald eagles, small mammals, and bear. Estuarine wetlands occupy 11 acres on inventoried National Forest System lands on the project area (Table WETL-1). Emergent sedge communities are found in sloughs, terraces between estuary channels, and along adjacent low to mid-level terraces. Inundated by higher tides, these communities are dominated by Lyngbye's sedge, large-awned sedge, red fescue, and sea milkwort. Intertidal/subtidal mudflats are partially exposed during low tides, and typically are unvegetated. The acreage in this classification only includes lands where soils and vegetation both meet criteria for estuaries. VCU 678 is the only area with identified estuary on inventoried National Forest System lands on the project area (Tables WETL-2 and WETL-3).

Lacustrine wetlands are the open water areas of lakes and ponds. A total of 830 acres are identified on inventoried National Forest System lands on the project area. VCU 681 has the greatest acreage of lakes and ponds (Table WETL-2).

Riverine habitats include streams and rivers. Approximately 854 acres of streams are present on inventoried National Forest System lands on the project area (Table WETL-1). VCU 678 has the greatest acreage of streams (Table WETL-2). Table AQU-3 provides additional information on the major salmon producing streams on the project area.

Table WETL-2
Acres of Wetland Classes by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Forested (Mineral)	Forested (Organic)	Muskeg (Mineral)	Muskeg (Organic)	Estuarine	Lacustrine	Riverine
674	779	67	2	130	0	0	54
677	435	231	32	605	0	78	155
678	1,014	195	132	853	11	8	264
679	2,605	1,811	28	982	0	176	174
680	1,051	1,732	0	355	0	56	69
681	933	1,092	0	451	0	503	109
682	1,365	798	12	224	0	9	29
Total	**8,182**	**5,926**	**206**	**3,600**	**11**	**830**	**854**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table WETL-3
Acres of Vegetated Wetlands and Nonwetlands by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Estuarine	Muskeg	Forested (Organic)	Forested (Mineral)	Total Wetlands	Non-Wetland	Total	Percent Wetland
674	0	132	67	779	978	944	1,922	51
677	0	637	231	435	1,303	1,744	3,047	43
678	11	985	195	1,014	2,205	8,783	10,988	20
679	0	1,010	1,811	2,605	5,426	5,941	11,367	48
680	0	355	1,732	1,051	3,138	739	3,877	81
681	0	451	1,092	933	2,476	2,257	4,733	52
682	0	236	798	1,365	2,399	1,993	4,392	55
Total	**11**	**3,806**	**5,926**	**8,182**	**17,925**	**22,401**	**40,326**	**44**

SOURCE: USDA-Forest, Ketchikan Area GIS Data Base 1996.

Values and Functions

Wetland functions are the physical, chemical, and biological processes or attributes necessary to maintain the integrity of the wetland/upland landscape system (Adams et al., 1987, cited in Harza 1995). These functions can be grouped into three classes: hydrologic, including flood flow moderation and ground water exchange; water quality improvement, including sediment deposition and nutrient exchange; and biologic, including primary productivity, habitat structure, and species diversity. Wetland values are those characteristics of wetlands that are perceived as valuable to society, such as aesthetics, recreational use, commercial fishing, timber harvest, and development sites.

Palustrine wetlands in the project area, particularly muskegs, are moderately important to water quality improvement, flood flow attenuation, and biological production. Palustrine wetlands generally play an important role in groundwater recharge and discharge. Socio-economic values of palustrine wetlands are generally low to moderate, although forested wetlands on organic and mineral soils can have low to moderate economic value.

Estuarine wetlands serve very important biological and water quality functions in relation to primary and secondary productivity, structural and chemical habitat attributes, and species diversity. Hydrologic functions of floodflow alteration and ground water exchange are of lesser importance in estuarine wetlands. Socio-economic values of estuarine wetlands are generally moderate to high.

Lacustrine wetlands support moderate levels of water quality improvement functions, and moderate to high levels of hydrologic functions. Biologic functions vary from low to high, depending on the size, productivity, and species use of the lake. Aesthetic and recreational values of lakes are generally moderate to high; other socio-economic values are variable in importance.

Riverine wetlands provide high levels of hydrologic functions and moderate to high levels of water quality improvement functions. Biological support varies from low, in small, high gradient mountain streams, to high, in large, low-elevation salmon-bearing streams. Recreational and aesthetic values vary from low to very high, depending on stream characteristics, fishing potential, and accessibility. Other socio-economic values are variable in importance.

Effects of the Alternatives

Direct and Indirect Effects

Effects of Proposed Harvest on Wetlands

Vegetated wetlands comprise approximately 44 percent, or 17,925 acres, of the inventoried National Forest System lands on the project area (Table WETL-3). More important is the forested, muskeg, and estuarine wetlands that could be impacted by harvest operations. Tables WETL-4 to WETL-9 estimate lands to be affected by timber harvest on these wetlands for the action alternatives, and lands currently affected. Estuarine lands should not be affected by timber harvest under this project because 1,000 foot beach buffers were implemented in the TLMP RSDEIS (1996a). Roads may still be located in this buffer zone, however. VCU 679 has the greatest acreage of forested wetlands on organic soils, forested wetlands on mineral soil, and total vegetated wetlands affected by current harvest (Table WETL-4). Acreage of wetlands harvested by the action alternatives from greatest to least is:

6 greater than 5 slightly greater than 3 slightly greater than 4 much greater than 2 (Tables WETL-5 to WETL-9).

Muskegs are generally unsuitable for timber harvest; however, small muskegs included in larger forested tracts may be affected by harvest and adjacent yarding operations. BMPs will be applied for the protection of water quality and will protect wetland water quality improvement functions. Timber harvest on forested wetlands with mineral soils may temporarily change the hydrology of the site. Patric (1966, cited in Harza 1995) suggests an increase in water yield may result from timber harvest. A temporary increase in soil moisture is expected until vegetation is re-established on the site.

Site productivity on wetland soils is typically lower than on more well-drained soils. Concurrently, growth rates are expected to be slower on wetland than on non-wetland sites, and merchantable timber may not be available on a 100-year rotation. VCU 681 has the greatest percentage of harvest on vegetated wetlands for the existing condition (Table WETL-4). Harvest on vegetated wetlands exceeds 50 percent on this VCU. VCUs with the greatest portion of vegetated wetlands harvested by action alternatives are: 674 for Alternatives 6, 4, and 3; 680 for Alternative 5; 681 for current harvest; and 682 for Alternative 2 (Tables WETL-5 to WETL-9). VCUs by alternative with greater than 50 percent of their timber harvest on vegetated wetlands are: VCUs 680 and 682 for Alternative 2; 674, 678, and 680 for Alternative 3; 674 for Alternative 4; 674, 678, and 680 for Alternative 5; and 674 and 680 for Alternative 6. These figures can give a misleading impression of impact to wetlands when a small acreage is to be harvested in a VCU and it is all scheduled on wetlands. Harvest in VCU 674 for Alternatives 3 and 4 is an example. The percent of harvest on vegetated wetlands by alternative ranked from greatest to least is 5 (45 percent), 3 (45 percent), 6 (35 percent), 4 (32 percent), 2 (31 percent), and current harvest (20 percent) (Tables WETL-4 to WETL-9).

A more informative analysis for affects of harvest on wetlands is the portion of the vegetated wetlands in a VCU that will be harvested. Comparison of VCUs and alternatives shows all will have less than 15 percent of vegetated wetlands harvested (Tables WETL-4 to WETL-9). Only VCU 674 in action Alternatives 5 (12 percent) and 6 (13 percent) will have more than 10 percent of harvest in a VCU on vegetated wetlands.

Table WETL-4
Acres of Timber Currently Harvested on Vegetated Wetlands by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Estuarine	Muskeg	Forested (Organic)	Forested (Mineral)	Total Wetlands	Non-Wetland	Total	Percent Harvest on Wetlands	Percent Wetlands Harvested
674	0	0	0	0	0	0	0	0	0
677	0	5	5	3	13	65	78	16	1.0
678	0	3	24	47	74	358	432	17	3.4
679	0	7	82	77	166	1,063	1,229	13	3.1
680	0	2	33	50	85	183	268	32	2.7
681	0	9	40	36	85	80	165	52	3.4
682	0	0	0	12	12	21	33	38	0.5
Total	**0**	**26**	**184**	**225**	**435**	**1,770**	**2,205**	**20**	**2.4**

SOURCE: USDA-Forest, Ketchikan Area GIS Data Base 1996.

Table WETL-5
Acres of Timber Harvested Under Alternative 2 on Vegetated Wetlands by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Estuarine	Muskeg	Forested (Organic)	Forested (Mineral)	Total Wetlands	Non-wetland	Total	Percent Harvest on Wetlands	Percent Wetlands Harvested
674	0	0	0	0	0	0	0	0	0
677	0	0	0	0	0	0	0	0	0
678	0	0	0	0	0	0	0	0	0
679	0	1	24	152	177	416	593	30	3.3
680	0	1	91	0	92	58	150	61	2.9
681	0	4	29	20	53	233	286	19	2.1
682	0	0	1	1	2	0	2	100	0.1
Total	0	6	**145**	**173**	**324**	**707**	**1,031**	**31**	**1.8**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table WETL-6
Acres of Timber Harvested Under Alternative 3 on Vegetated Wetlands by VCU on Inventoried National Forest System lands on the Chasina Project Area

VCU	Estuarine	Muskeg	Forested (Organic)	Forested (Mineral)	Total Wetlands	Non-Wetland	Total	Percent Harvest on Wetlands	Percent Wetlands Harvested
674	0	0	0	18	18	0	18	100	1.8
677	0	0	0	0	0	0	0	0	0
678	0	12	7	143	162	61	223	72	7.3
679	0	3	87	308	398	518	916	44	7.3
680	0	1	99	8	108	58	166	65	3.4
681	0	4	29	20	53	233	286	18	2.1
682	0	0	22	35	57	95	152	37	2.4
Total	**0**	**20**	**244**	**532**	**796**	**965**	**1,761**	**45**	**4.4**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table WETL-7
Acres of Timber Harvested Under Alternative 4 on Vegetated Wetlands by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Estuarine	Muskeg	Forested (Organic)	Forested (Mineral)	Total Wetlands	Non-Wetland	Total	Percent Harvest on Wetlands	Percent Wetlands Harvested
674	0	0	0	26	26	0	26	100	2.6
677	0	0	1	2	3	28	31	10	0.2
678	0	12	9	157	178	192	370	48	8.1
679	0	2	59	285	346	896	1,242	28	6.4
680	0	0	2	3	5	22	27	19	0.2
681	0	4	12	41	57	259	316	18	2.3
682	0	0	31	114	145	249	394	37	6.0
Total	**0**	**18**	**114**	**628**	**760**	**1,646**	**2,406**	**32**	**4.2**

SOURCE USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table WETL-8
Acres of Timber Harvested Under Alternative 5 on Vegetated Wetlands by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Estuarine	Muskeg	Forested (Organic)	Forest (Mineral)	Total Wetlands	Non-Wetland	Total	Percent Harvest on Wetlands	Percent Wetlands Harvested
674	0	0	0	120	120	18	138	87	12.3
677	0	0	1	2	3	28	31	10	0.2
678	0	12	9	155	176	131	307	57	8.0
679	0	3	100	348	451	772	1,223	37	8.3
680	0	1	84	8	93	5	98	95	3.0
681	0	0	17	5	22	60	82	27	0.9
682	0	0	0	0	0	11	11	0	0
Total	**0**	**16**	**211**	**638**	**865**	**1,025**	**1,890**	**46**	**4.8**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table WETL-9
Acres of Timber Harvested Under Alternative 6 on Vegetated Wetlands by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Estuarine	Muskeg	Forested (Organic)	Forested (Mineral)	Total Wetlands	Non-Wetland	Total	Percent Harvest on Wetlands	Percent Wetlands Harvested
674	0	0	0	128	128	18	146	88	13.1
677	0	0	7	24	31	112	143	22	2.4
678	0	12	11	160	183	387	570	32	8.3
679	0	3	100	391	494	1,026	1,520	32	9.1
680	0	5	129	51	185	81	266	70	5.9
681	0	6	41	65	112	478	590	19	4.5
682	0	0	31	114	145	283	428	34	6.0
Total	**0**	**26**	**319**	**933**	**1,278**	**2,385**	**3,663**	**35**	**7.1**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Effects of Road Construction on Wetlands

Tables WETL-10 to WETL-15 estimate lands to be affected by road construction on vegetated wetlands by VCUs for action alternatives and existing roads. The area estimated to be affected by roads is averaged as 37.5 feet on each side of the road center line, 75 feet total width, and 9.1 acres per mile. This figure includes rock pits, landings, turnouts, and areas where endhaul material is deposited. The 9.1 acres of disturbance per mile of road in these tables is believed to over estimate the lands affected by roads because the 75 feet is the clearing width, plus, overlay construction techniques will disturb less soil beneath the road surface. Still, the acreage figures are valid for making comparisons.

Acres of vegetated wetlands to be affected by roads and ranking alternatives from greatest to least is: 6 greater than 3 slightly greater than 5 greater than 4 greater than 2 greater than existing (Tables WETL-10 to WETL-15). Ranking of alternatives by percent of roads on vegetated wetlands from greatest to least is: 3 slightly greater than 5 barely greater than 6 greater than 2 greater than 4 slightly greater than current.

The preceding comparison of percent of roading that will be done on wetlands is commonly done in other EISs, and was presented here. A more informative analysis for affects of roading on wetlands is the portion of the vegetated wetlands in a VCU that will be roaded. Percent of vegetated wetlands to be affected by roads is less than 3 percent for all VCUs for all alternatives (Tables WETL-10 to WETL-15).

Table WETL-10
Acres of Existing Roads on Vegetated Wetlands by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Estuarine	Muskeg	Forested (Organic)	Forested (Mineral)	Total Wetlands	Non-Wetland	Total	Percent Roads on Wetlands	Percent Wetlands Roaded
674	0	0	0	0	0	0	0	0	0
677	0	0	0	0	0	0	0	0	0
678	0	0	0	0	0	0	0	0	0
679	0	3	15	15	33	110	143	23	0.6
680	0	0	0	0	0	0	0	0	0
681	0	0	0	0	0	0	0	0	0
682	0	0	0	0	0	0	0	0	0
Total	**0**	**3**	**15**	**15**	**33**	**110**	**143**	**23**	**0.2**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table WETL-11
Acres of Roads Under Alternative 2 on Vegetated Wetlands by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Estuarine	Muskeg	Forested (Organic)	Forested (Mineral)	Total Wetlands	Non-Wetland	Total	Percent Roads on Wetlands	Percent Wetlands Roaded
674	0	0	0	0	0	0	0	0	0
677	0	0	0	0	0	0	0	0	0
678	0	0	0	0	0	0	0	0	0
679	0	1	16	25	42	96	138	31	0.8
680	0	1	16	0	17	5	22	77	0.5
681	0	0	7	3	10	23	33	31	0.4
682	0	0	0	0	0	0	0	0	0
Total	**0**	**2**	**39**	**28**	**69**	**124**	**193**	**36**	**0.4**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table WETL-12
Acres of Roads Under Alternative 3 on Vegetated Wetlands by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Estuarine	Muskeg	Forested (Organic)	Forested (Mineral)	Total Wetlands	Non-Wetland	Total	Percent Roads on Wetlands	Percent Wetlands Roaded
674	0	0	0	11	11	0	11	100	1.1
677	0	0	0	0	0	0	0	0	0
678	0	3	2	36	41	1	42	98	1.9
679	0	6	31	61	98	123	221	44	1.8
680	0	< 1	17	< 1	17	6	23	75	0.5
681	0	2	12	14	28	35	63	45	1.1
682	0	< 1	17	19	36	23	59	62	1.5
Total	**0**	**11**	**79**	**141**	**231**	**188**	**419**	**56**	**1.3**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table WETL-13
Acres of Roads Under Alternative 4 on Vegetated Wetlands by VCU on Inventoried National Forest System lands on the Chasina Project Area

VCU	Estuarine	Muskeg	Forested (Organic)	Forested (Mineral)	Total Wetlands	Non-Wetland	Total	Percent Roads on Wetlands	Percent Wetlands Roaded
674	0	0	0	0	0	0	0	0	0
677	0	0	< 1	1	2	3	5	32	0.1
678	0	0	0	0	0	0	0	0	0
679	0	4	24	45	73	211	284	26	1.3
680	0	0	0	0	0	2	2	0	0
681	0	1	1	1	3	9	12	23	0.1
682	0	3	4	3	10	10	20	49	0.4
Total	**0**	**8**	**30**	**50**	**88**	**235**	**323**	**27**	**0.5**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table WETL-14
Acres of Roads Under Alternative 5 on Vegetated Wetlands by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Estuarine	Muskeg	Forested (Organic)	Forested (Mineral)	Total Wetlands	Non-Wetland	Total	Percent Roads on Wetlands	Percent Wetlands Roaded
674	0	0	0	24	24	0	24	100	2.4
677	0	0	< 1	1	2	3	5	32	0.1
678	0	3	2	36	41	1	42	98	1.9
679	0	6	32	70	108	185	293	37	2.0
680	0	< 1	16	< 1	16	4	20	81	0.5
681	0	0	6	2	8	14	22	38	0.3
682	0	2	3	1	6	4	10	64	0.2
Total	**0**	**11**	**60**	**134**	**205**	**211**	**416**	**49**	**1.1**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table WETL-15
Acres of Roads Under Alternative 6 on Vegetated Wetlands by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Estuarine	Muskeg	Forested (Organic)	Forested (Mineral)	Total Wetlands	Non-Wetland	Total	Percent Roads on Wetlands	Percent Wetlands Roaded
674	0	0	0	24	24	0	24	100	2.4
677	0	< 1	5	10	15	8	23	65	1.1
678	0	3	2	36	41	1	42	98	1.9
679	0	6	35	72	113	226	339	33	2.1
680	0	2	26	12	40	9	49	81	1.3
681	0	5	17	18	40	67	107	37	1.6
682	0	4	23	34	61	67	128	48	2.5
Total	**0**	**20**	**108**	**206**	**334**	**378**	**712**	**47**	**1.9**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Construction of new roads on wetlands will be limited to the necessary transportation components of roads, landings, and drainage structures. Road development necessitates the alteration of wetland vegetation within the road right-of-way; however, BMPs will be used to ensure protection of water quality, hydrologic processes, and biological functions of the wetlands. BMPs will be applied in cases where use of wetlands as filter strips to capture sediment is a concern. Ditch construction will be minimized on open muskegs to the extent practical to minimize both water accumulation on the road surface and sediment production. To ensure continuing hydrologic functions of wetlands, culverts and other road drainage features should be located to maintain water levels and flows at natural levels. Rock overlay, a highly permeable fill, will be used to minimize changes to wetland hydrology.

Through application of BMPs, impacts of road construction should be limited to the wetland directly underlying the road and adjacent cuts and fills. Water flow, circulation patterns, and chemical and biological characteristics of the water within wetlands should be maintained. Adverse effects to fisheries habitat should be minimized. Wildlife use of wetlands may be altered by road construction, depending on the species. Small species may be displaced from the immediate roadway; larger species using wetlands as travel corridors and foraging areas may be displaced during periods of vehicular traffic on the roads. Species sensitive to disturbance may be displaced on a long-term basis from roads with high traffic levels.

Federal agencies exercising statutory authority and leadership over Federal lands are required under Executive Order 11990 to preserve and enhance the natural and beneficial values of wetlands while carrying out their responsibility for: (1) acquiring, managing, and disposing of land and facilities; (2) providing federally undertaken, financed, or associated construction and improvements; and (3) conducting Federal activities and programs affecting land use.

Locations of proposed roads and harvest units were field or office verified by logging engineers along with soils, wildlife, fisheries, and other resource specialists. Road segments will be relocated and units modified when necessary to ensure avoidance of impact to critical wetlands. Site-specific design and mitigation will be used to minimize the extent of impacts to other wetlands. BMPs assigned for protection of water quality and fisheries habitat will also serve to protect wetland functions and values.

Cumulative Effects

Tables WETL-16 to WETL-20 estimate the acres of timber to be harvested and roads to be constructed under this project, and to 2040.

Alternatives ranked from greatest to least in acreage of vegetated wetlands affected by timber harvest under this project are: 6 greater than 5 slightly greater than 3 slightly greater than 4 greater than 2 greater than existing (Table WETL-16). Percent of wetlands in VCUs affected by timber harvest is less than 14 percent for all VCUs for all alternatives. VCUs with the greatest percentage of wetlands affected by alternatives are: 678 and 681 for existing; 679 for Alternative 2; 678 for Alternatives 3 and 4; and 674 for Alternatives 5 and 6. All alternatives will affect less than 10 percent of the wetlands on inventoried Forest Service lands in the project area.

Table WETL-16
Projected Cumulative Acres of Timber Harvested and Percent of VCU Affected on Vegetated Wetlands on Inventoried National Forest System Lands on the Chasina Project Area

	Existing		Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt. 6		2040*	
VCU	Ac.	%	Ac.	%	Ac.	%	Ac.	%	Ac.	%	Ac.	%	Ac.	%
674	0	0	0	0	18	1.8	26	2.7	120	12.3	128	13.1	33	3.4
677	13	1.0	13	1.0	13	1.0	16	1.2	16	1.2	44	3.4	537	41.2
678	74	3.4	74	3.4	236	10.7	252	11.4	250	11.3	257	11.6	844	38.3
679	166	3.1	343	6.3	564	10.4	512	9.4	617	11.4	660	12.2	1,254	23.1
680	85	2.7	177	5.6	193	6.2	90	2.9	178	5.7	270	8.6	546	17.4
681	85	3.4	138	5.6	138	5.6	142	5.7	107	4.3	197	8.0	401	16.2
682	12	0.5	14	0.6	69	2.9	157	6.5	12	0.5	157	6.5	88	3.7
Total	**435**	**2.4**	**759**	**4.2**	**1,231**	**6.9**	**1,195**	**6.7**	**1,300**	**7.2**	**1,713**	**9.6**	**3,703**	**20.7**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

* Uses Alternative 3.

Alternatives ranked from greatest to least in acreage of vegetated wetlands affected by roads under this project are: 6 greater than 3 slightly greater than 5 greater than 4 slightly greater than 2 greater than existing (Table WETL-17). Percent of wetlands in VCUs affected by

roads is less than 3 percent for all VCUs for all alternatives. The VCU with the greatest percentage of wetlands affected by alternatives is 679 for all alternatives. All alternatives will affect less than 3 percent of the wetlands on inventoried National Forest System lands in the project area.

Table WETL-17

Projected Cumulative Acres of Roads and Percent of VCU Affected on Vegetated Wetlands on Inventoried National Forest System Lands on the Chasina Project Area

	Existing		Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt. 6		2040*	
VCU	Ac.	%	Ac.	%	Ac.	%	Ac.	%	Ac.	%	Ac.	%	Ac.	%
674	0	0	0	0	11	1.1	0	0	24	2.4	24	2.4	13	1.3
677	0	0	0	0	0	0	2	0.1	2	0.1	15	1.1	78	6.0
678	0	0	0	0	41	1.9	0	0	41	1.9	41	1.9	132	6.0
679	33	0.6	75	1.4	131	2.4	106	1.9	141	2.6	146	2.7	234	4.3
680	0	0	17	0.5	17	0.5	0	0	16	0.5	40	1.3	70	2.2
681	0	0	10	0.4	28	1.1	3	0.1	8	0.3	40	1.6	67	2.7
682	0	0	0	0	36	1.5	10	0.4	6	0.2	61	2.5	39	1.6
Total	**33**	**0.2**	**102**	**0.6**	**264**	**1.5**	**121**	**0.7**	**238**	**1.3**	**367**	**2.0**	**633**	**3.5**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

* Uses Alternative 3.

Alternatives ranked from greatest to least in acreage of vegetated wetlands affected both by timber harvest and roads under this project are similar to results for harvest units: 6 greater than 5 slightly greater than 3 greater than 4 greater than 2 greater than existing (Table WETL-18). This follows because of the much greater acreage of harvest units than roads. Percent of wetlands in VCUs affected by timber harvest and roads is less than 16 percent for all VCUs for all alternatives. VCUs with the greatest percentage of wetlands affected by alternatives are: 679 for existing, Alternatives 2 and 3; 679 and 678 for Alternative 4; and 674 for Alternatives 5 and 6. All alternatives will affect less than 12 percent of the wetlands on inventoried National Forest System lands in the project area.

Table WETL-18

Projected Cumulative Acres of Timber Harvest and Roads and Percent of VCU Affected on Vegetated Wetlands on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Existing Ac.	Existing %	Alt. 2 Ac.	Alt. 2 %	Alt. 3 Ac.	Alt. 3 %	Alt. 4 Ac.	Alt. 4 %	Alt. 5 Ac.	Alt. 5 %	Alt. 6 Ac.	Alt. 6 %	2040* Ac.	2040* %
674	0	0	0	0	29	3.0	26	2.7	144	14.7	152	15.5	46	4.7
677	13	1.0	13	1.0	13	1.0	18	1.4	18	1.4	59	4.5	615	47.2
678	74	3.4	74	3.4	277	12.6	252	11.4	291	13.2	298	13.5	976	44.3
679	199	3.7	418	7.7	695	12.8	618	11.4	758	14.0	806	14.8	1,488	27.4
680	85	2.7	194	6.2	210	6.7	90	2.9	194	6.2	310	9.9	616	19.6
681	85	3.4	148	6.0	166	6.7	145	5.8	115	4.6	237	9.6	468	18.9
682	12	0.5	14	0.6	105	4.4	167	7.0	18	0.8	218	9.1	127	5.3
Total	**468**	**2.6**	**861**	**4.8**	**1,495**	**8.3**	**1,316**	**7.3**	**1,538**	**8.6**	**2,080**	**11.6**	**4,336**	**24.2**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

* Uses Alternative 3.

Table WETL-19 projects timber harvest on vegetated wetlands by VCU to 2040. Table WETL-20 projects acres of roads on vegetated wetlands by VCU to 2040. Table WETL-16 projects cumulative acres of harvest and percent of VCUs affected to 2040. Table WETL-17 does the same for roads. Table WETL-18 does the same for timber and roads combined. The following assumptions were used to project future harvest and road construction on vegetated wetlands on inventoried National Forest System lands through the reasonably foreseeable future, 2040. The operable timber base will remain the same as currently identified (TLMP 1991); standards and guidelines for harvest and road construction activity will remain the same; access to timber in relation to wetlands will remain the same; and all suitable and available timber (TLMP 1991) will be harvested by 2040. Estimations to 2040, use Alternative 3 of this project.

Table WETL-19
Projected Acres of Timber Harvested to 2040, on Vegetated Wetlands by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Estuarine	Muskeg	Forested (Organic)	Forested (Mineral)	Total Wetlands	Non-Wetland	Total	Percent Harvest on Wetlands	Percent Wetlands Harvested
674	0	15	0	0	15	50	65	23	1.5
677	0	524	0	< 1	524	2,116	2,640	20	40.2
678	0	608	0	0	608	6,291	6,899	9	27.6
679	0	679	9	2	690	7,391	8,081	8	12.7
680	0	353	0	0	353	3,209	3,562	10	11.2
681	0	263	0	< 1	263	2,922	3,185	8	10.6
682	0	19	0	0	19	27	46	42	0.8
Total	**0**	**2,461**	**9**	**2**	**2,472**	**22,006**	**24,478**	**10**	**13.8**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table WETL-20
Projected Acres of Roads to 2040, on Vegetated Wetlands by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Estuarine	Muskeg	Forested (Organic)	Forested (Mineral)	Total Wetlands	Non-Wetland	Total	Percent Roads on Wetlands	Percent Wetlands Roaded
674	0	2	0	0	2	7	9	22	0.2
677	0	78	0	< 1	78	317	395	20	6.0
678	0	91	0	0	91	942	1,033	9	4.1
679	0	102	1	< 1	103	1,107	1,210	8	1.9
680	0	53	0	0	53	635	688	8	1.7
681	0	39	< 1	< 1	39	438	477	8	1.6
682	0	33	0	0	3	4	7	43	0.1
Total	**0**	**368**	**1**	**< 1**	**369**	**3,450**	**3,819**	**10**	**2.1**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Mitigation Measures

Mitigation measures designed to protect wetland areas involve, to the extent possible, the avoidance of wetlands during office planning and field reconnaissance. Additionally, in some cases, suspension is required during logging, and in others, wetland buffers for wildlife are prescribed. Field layout of road systems allows site-specific identification of small drainages in wetlands requiring culverts and the road segments requiring additional culverts and permeable subgrades to maintain water circulation. Culverts and permeable subgrade materials are required when roads cross wetlands; these road segments are identified on the road design cards. Additionally, the use of BMPs in both construction and maintenance ensures that flows, circulation patterns, and chemical and biological characteristics of the wetland waters will be minimally impaired. Implementation of these procedures is required to maintain the physical and chemical functions of wetlands (EPA 1993, cited in Foster Wheeler 1995).

Monitoring

The Forest Plan recognizes three distinct types of monitoring: implementation, effectiveness, and validation. Implementation monitoring determines if projects and activities comply with Forest Plan Standards and Guidelines. Effectiveness monitoring determines whether the standards and guidelines achieve the desired results. Validation monitoring determines whether the assumptions in the Forest Plan regarding the relationship between management actions and their effects are correct, or if there is a better way to depict these relationships.

A monitoring plan has been developed for the Tongass National Forest by the Forest Planning Team and is described in TLMP Draft Revision (1991a). The Forest Plan contains no specific monitoring goals for wetlands. Monitoring for this resource generally is covered by the soils and water monitoring BMPs. In accordance with the 1992 Memorandum of Agreement between the Alaska Department of Environmental Conservation and the USDA-Forest Service Alaska Region, the Forest Service performs annual BMP implementation and effectiveness monitoring. The Chasina Project Area will be part of the Forest Plan monitoring and the Ketchikan Area Monitoring Strategy.

Project-specific monitoring that is unique to the Chasina Project Area, and that would not be included in regular Forest Plan or routine implementation monitoring, has been identified for several resources. Project-specific monitoring is not planned for wetland resources on the Chasina Project Area.

Soils

Key Terms

Best Management Practices (BMPs)—methods, measures, or practices to prevent or reduce water pollution, including, but not limited to, structural and nonstructural controls, operation and maintenance procedures, other requirements, and scheduling and distribution of activities. These are primary control mechanisms for non-point sources of pollution on National Forest System lands. Control of non-point source pollution is required by the Clean Water Act. BMPs must be consistent with State regulations (USDA FSH 2509.22, 1993).

Glacial till—gravel, boulders, sand and finer materials transported and deposited by a glacier. Till is often a dense, hard layer underlying soil and overlying bedrock.

Mass Movement Index (MMI)—rating used to estimate potential of soils in soil map units to fail in a mass movement event. Ratings vary from low (least potential), moderate, high, and very high (greatest potential).

Mass movement/mass wasting—general term for processes where large masses of earth materials are moved downslope by gravity. Commonly referred to as landslides.

Soil—technical term for what is commonly referred to as dirt. Soil is made up of both mineral and organic materials that cover much of the earth's surface. It contains living matter and it generally supports the growth of vegetation (Soil Survey Staff 1992). Each type of soil has specific properties that differ from other soils. Each type of soil is given a name.

Soil depth—depth to non-soil materials, which are generally rock or glacial till. Depth classes are: shallow = 20 inches or less; moderately deep = 20 to 40 inches; deep = greater than 40 inches.

Soil drainage—rate of movement of water through the soil and time water is contained in the soil.

Soil map unit (SMU)—collection of areas defined and named the same in terms of their soils components, or miscellaneous areas, or both. Each map unit consists of one or more components. (Soil Survey Division Staff 1993).

Soil productivity—capacity of a soil to produce plant growth. Related to inherent chemical, physical, and biological properties of soil.

Value Comparison Unit (VCU)—area generally encompassing a drainage basin containing one or more large stream systems. Boundaries usually follow watershed divides.

V-Notch—a shallow to deeply cut stream drainage, generally in steep mountainous terrain. Looks like a "V" from a frontal or overhead view.

Wetlands—areas inundated by surface or groundwater with a frequency or duration sufficient to support a prevalence of vegetation typically adapted to life in saturated soil conditions. Classification of wetlands is based on soil, vegetation, and hydrology factors. Wetlands in Southeast Alaska include muskegs, estuaries, and forested wetlands.

Affected Environment

Geologic processes and the type of rocks resulting from these processes have shaped the landscape in Southeast Alaska. This information is presented in the Geology section in Chapter 3 of this document. Glaciers and weathering further shaped the landscapes formed by geologic processes. Tectonic uplift and fluvial erosion and deposition have continued to modify the landscape since the retreat of the glaciers, about 10,000 years. Soils that form are closely related to these processes and parent materials.

Soil varies from place to place. Soils are a result of climate and living organisms acting on parent material, topography (local relief), and the time that the soil forming processes have acted (Soil Survey Division Staff 1993). The development and properties of soil in Southeast Alaska are influenced by high levels of rainfall, a short growing season, cool summer temperatures, and cool soil temperatures. These conditions result in soils that, when compared to soils in other parts of the United States, are generally less deep, have poorer drainage, and have a greater accumulation of organic matter.

Soils in the project area have developed from a variety of inorganic (mineral) and organic (vegetative) sources. Soils are often classified as either mineral or organic. Mineral soils develop from glacial deposits, stream and uplifted marine sediments, metamorphic and igneous rock, and colluvium. Organic soils are the remnants of plants that have only partially decomposed. Most organic soils form in areas where water collects because of relief, an impermeable subsurface layer, or both.

National Forest System lands have been inventoried to identify the soil resource (USDA-Forest Service 1994c). Non-National Forest System lands, private and state, were not mapped. This includes private and State lands. Land exchanges following the survey resulted in some lands under other ownership having a soil inventory, and some National Forest System lands not being inventoried. The project area is approximately 68,904 acres. National Forest System lands occupy 44,255 acres of the project area, of which 41,158 acres have had a soil inventory and 3,097 acres are not mapped. Lands under other ownership occupy 24,649 acres, of which 15, 760 acres are not mapped and 8,889 acres are mapped. Analysis for this section was done primarily on National Forest System lands where the soil inventory has been done. The entire project area was analyzed for the Cumulative Effects section

The following areas and harvest units on the project area include National Forest System lands that do not have soil inventory information. Lancaster/Kitkun area and units: 679-503, 679-320, east half of 679-323 and 679-505, 679-318, 679-325, 679-328, 679-331, and northwest portion of 679-337. Port Johnson area and units: southeast corner of 681-352, east half of 681-361, 681-363, 681-365, 681-367, north portions of 681-368, 681-372, 681-383, and west third of 681-376. Unmapped lands were reviewed as part of the site and office reviews of these units (Appendix J).

Soil Productivity

Characteristics and conditions of soil affect the productivity of many other forest resources. Tree growth, wildlife and fish habitat, and recreation opportunities are influenced by soils. Soil drainage, soil depth, and type of soil (mineral versus organic) are responsible for the greatest differences in forest productivity in Southeast Alaska. Well drained soils are generally the most productive. All but one of the well-drained soils are mineral. Drainage in

mineral soil ranges from well-to-poorly drained. Most organic soils are poorly or very poorly drained. McGilvery is the only well drained organic soil. It is a shallow soil. The poorly drained organic soils are usually moderately deep to deep, but may be shallow also. Depth of well drained mineral soil ranges from deep to shallow. Poorly drained mineral soils are usually shallow. Mineral soils are generally more productive than organic soils.

Soil Types

The following soils are of particular concern on the project area. Acres of soils are summarized in Table SOILS-1 and SOILS-2. Figure SOILS-1 illustrates the variable distribution of these soils on the project area.

Forested Wetlands

Poorly drained soils are often wetlands. Forested wetlands include all poorly drained mineral soils and that portion of the poorly drained organic soils that support forest vegetation. Poorly drained organic soils that do not support forest vegetation are commonly called muskegs.

McGilvery Soils

McGilvery soil is generally a moss layer overlying rock on steeper slopes. This well drained, organic soil supports forest vegetation. The TLMP Draft Revision (TLMP 1991a) proposed that soil map units (SMUs) with more than 41 percent McGilvery soils be removed from the tentatively suitable base, but can be considered for timber harvest on a case-by-case basis.

Riparian Soils

Mineral soils on floodplains adjacent to some creeks are generally highly productive. These soils are generally deep and well drained. They are known as riparian soils. Riparian soils for this classification include estuary soils that occur at the mouths of some streams.

Karst

Areas of carbonate limestone and marble are commonly referred to as karst. Soils on karst are primarily well drained and mineral. Productivity of these soils is generally high. McGilvery soil occurs on karst also. Acreage of soils on karst may be less than the acreage of karst noted in the geology section. The location of carbonate materials has been updated on National Forest System lands in the project area. This was done after the soils were mapped. Some areas of organic soils may overlay karst, but this is not characterized for these map units and the lands were not identified as karst on the soil inventory. An example is SMU 29 with McGilvery soils.

Glacial Till

Mineral soils on glacial till are generally more prone to landslides than are other mineral soils.

Table SOILS-1
Acres of Mineral Soil Types by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	Glacial Till	Karst	Riparian	Forested Wetland***	Other	Total*
674	0	0	149	781	657	1,587
677	0	0	0	467	1,178	1,645
678	135	0	195	1,136	5,342	6,808
679	0	928	214	2,632	3,803	7,577
680	282	7	8	1,818	318	1,200**
681	0	471	196	933	994	2,594
682	12	1	88	1,365	1,158	2,624
Total*	**429**	**1,407**	**850**	**8,132**	**13,450**	**24,035****

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

* Does not include acreage for lands not mapped.
** Includes correction for soils that are both till and wetland.
*** Does not include small acreage of open wetlands.

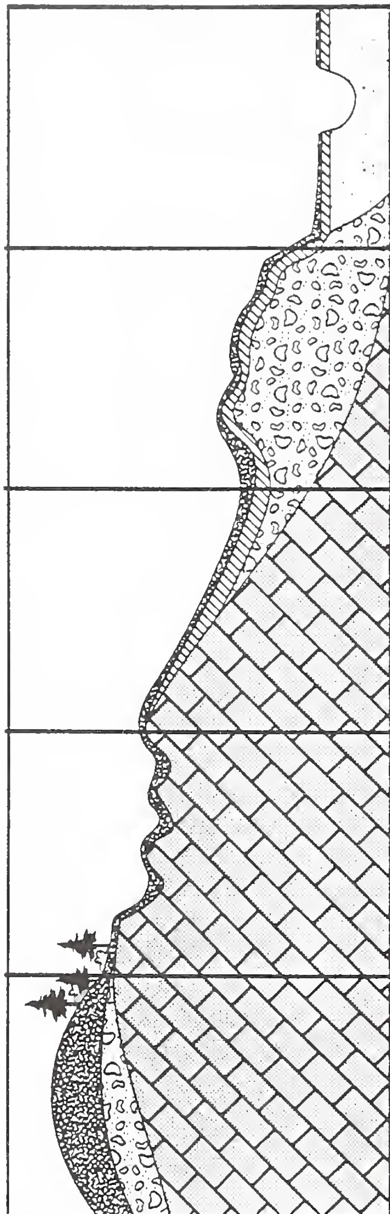
Table SOILS-2
Acres of Organic Soil Types by VCU on Inventoried National Forest System Lands on the Chasina Project Area

VCU	McGilvery <41%	McGilvery >41%	Other Forested	Muskeg	Total*
674	278	3	88	109	478
677	115	386	214	637	1,352
678	1,620	1,005	64	981	3,670
679	677	549	2,084	523	3,833
680	142	443	1,812	55	2,452
681	363	651	1,125	185	2,324
682	532	252	771	68	1,623
Total*	**3,727**	**3,289**	**6,158**	**2,558**	**15,732**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

* Does not include acreage for lands not mapped.

Figure SOILS-1
Schematic of Distribution of Soil Types on the Chasina Project Area



	Organic	McGilvery	Mineral	Till	Riparian
Description	Thick layer, partly to decomposed plant materials	Forest litter and partly decomposed plant material over bedrock	Shallow to deep soils developing in residuum or colluvium	Thin surface, soils developing in glacial till	Shallow to deep soils of stratified sand and gravel
Texture	Mucky peat	Peat	Sandy loam to silt loam	Sandy loam to silt loam	Sand and gravel
Soil Depth	7" to > 6'	< 8"	1' to > 6'	< 20" to < 6'	> 6'
Drainage	Poorly and very poorly drained	Well drained	Well to poorly drained	Well to poorly drained	Well to moderately well drained
Major Forest Types	Nonforest and varied forest types	Western hemlock	Western hemlock, mixed conifer	Western hemlock, Western hemlock/ yellowcedar	Sitka spruce
Landform	Ridgetops, benches, depressions, valley floor	Upper backslopes of hills and mountains	Valley floors, hillslopes, mountain sideslopes, ridgeslopes	Moraines, drumlins, and valley floor deposits	Floodplains, stream terraces
Mass Movement Index Class	Generally low	Low	Low to very high	Low to very high	Low
Timber site Productivity Class	Low to moderate	Medium to high	Medium to high	Medium to high	High
Wetland Habitat Potential	High	Low	Medium	Medium	Very high
Upland Habitat Potential	Low	Medium	High	High	Very high

Surface Erosion and Mass Movement

In the forest environment, surface erosion occurs when exposed soil is detached and transported by water. Most undisturbed soils in the Chasina Project Area are resistant to surface erosion due to a relatively thick, organic surface layer which absorbs large quantities of water and protects the soil from displacement. If this layer is removed, the underlying mineral soil is subject to rapid erosion.

Mass wasting is the dominant process of natural erosion and slope reduction in geologically youthful Southeast Alaska (Swanston 1969, cited in Harza 1995). Mass movement occurs when the soil materials can no longer resist the downslope component of gravity. The stability of soil on a slope is determined by soil strength, soil depth, type of soil, drainage and groundwater accumulation, slope gradient, vegetation, and type of material underlying soil.

Areas of natural mass wasting are associated with sideslopes within narrow V-notch drainages and the steep, upper sideslopes of valleys. Natural landslides occur most frequently on slopes steeper than 68 percent during periods of high-intensity rainfall (Swanston 1969, cited in Harza 1995). The increasing volume of water moving through the soil causes an increase in shear stress, due to rising seepage pressures and increasing weight of the soil material, and a decrease in shear resistance, resulting from increased pore-water pressure in the soil (Swanston 1970, cited in Harza 1995).

Two types of debris slides occur in the project area; those initiated in shallow soils over bedrock on extremely steep slopes, and those where soils derived from glacial till slide over compact unweathered till on moderately steep slopes. Organic soils, and well drained mineral soils on lesser slopes, typically have a low susceptibility to mass movement.

Swanston (1991, cited in Harza 1995) evaluated landslides greater than 100 cubic meters occurring between 1963 and 1983 in Southeast Alaska. He determined that 77 percent were of the debris avalanche and debris flow type that involve movement of water-charged soil, rock, and organic material down shallow gullies and hillslope depressions. The remaining 23 percent were debris torrents that are generally confined within deeply incised gullies and canyons. Sixty-two percent of all landslides initiate on slopes having an average gradient steeper than 75 percent, and an additional 30 percent develop on slopes between 56 and 75 percent. Landslides also appear to have a limited range of elevation, with 72 percent of all failures occurring below 1,320 feet elevation.

Mass movement indices (MMIs) have been assigned to soils in soil mapping units to rate the relative potential for soils to move by landslide events. The MMI classification has been developed and revised since 1969, by Ketchikan Area soil scientists. The MMI is based on slope, drainage, bedrock characteristics, parent material, soil characteristics, existing landslides, and vegetation.

Lands with a very high mass movement rating (very high MMI) are the most likely to fail by landslides. Areas having a very high MMI are not included in the suitable timber base for the project area. These generally include poorly drained mineral soils on slopes of 75 percent or greater. Visible indicators of very high MMI conditions include unstable soils, existing slumps or slides, jack-strawed trees, pistol-butted trees, wet mineral soil on very steep slopes, or a distinct change to relatively young vegetation or disturbance-preferring plant communities.

Very high MMI soils occur primarily in VCUs 674 and 678 (Table SOILS-3). These soils comprise 37 and 39 percent of these VCUs, respectively. The other VCUs have less than 20 percent of very high MMI soils.

Areas of high mass movement (high MMI) potential also require special consideration when planning and conducting timber harvest operations, such as partial suspension, landslide potential, etc. All watersheds in the project area have areas of high MMI soils (Table SOILS-3).

Table SOILS-3
Acres and Percent of Soil by Mass Movement Rating by VCU on Inventoried National Forest System Lands on the Chasina Project Area

	Mass Movement Index										
	Very High		High		Moderate		Low		Not Mapped		Total
VCU	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres
674	708	37	796	41	71	4	347	18	0	0	**1,922**
677	473	15	696	22	630	20	1,259	39	142	4	**3,200**
678	4,307	39	2,273	21	822	8	3,576	32	0	0	**10,978**
679	225	2	1,788	14	5,656	44	3,697	29	1,504	11	**12,870**
680	0	0	132	3	1,600	41	2,145	55	7	<1	**3,884**
681	436	7	419	7	1,860	30	2,018	33	1,429	23	**6,162**
682	277	6	1,416	32	1,715	39	984	22	14	<1	**4,406**
Total	**6,426**	**15**	**7,520**	**17**	**12,354**	**29**	**14,026**	**32**	**3,096**	**7**	**43,422**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Effects of the Alternatives

Soil disturbance is an unavoidable consequence of timber harvest and associated road construction. The severity of soil disturbance varies depending on site conditions and management practices employed. Factors such as parent material, soil depth and drainage, weather conditions, slope gradient, slope shape, slope length, drainage dissection, and type of disturbance influence the potential for adverse impacts. Areas most susceptible to adverse impacts have been identified and eliminated from consideration for timber harvest. These areas include the very high MMI soils, riparian soils, and some areas with greater than 41 percent McGilvery soils in timber units.

Properties of the six alternatives and their differences are summarized in Chapter 2. Discussion of alternatives in the soils and related sections generally refers to the action alternatives—Alternatives 2 through 6. Alternative 1 is the no-action alternative, and conditions would be the same as the existing condition if this alternative was implemented.

Direct and Indirect Effects

Direct and indirect effects of timber harvest and associated road construction fall into three general categories: reduced soil productivity, accelerated mass wasting, and accelerated surface erosion.

Soil Productivity

Yarding of logs by shovel or cable methods may result in soil displacement and loss of organic surface layers. Any site where suspension is not adequate or shovel operation is inadequate is particularly vulnerable to soil displacement during yarding. Reduced soil productivity and delayed regeneration of commercial tree species may occur where disturbance is severe. However, cable systems that partially or fully suspend logs generally cause minimal soil disturbance (Everest et. al. 1987, cited in Harza 1995). In general, at least partial log suspension is required on high MMI soils, forested wetland soils, and McGilvery soils.

The most significant adverse impact on soil productivity is construction of roads, landings, and rock pits that remove land from the productive base. Implementation of action alternatives would result in loss of soil productivity on the acreage affected by roads, landings, rock pits, turnouts, and endhaul deposit sites, in addition to the areas impacted by ground disturbance during yarding.

Table SOILS-4 estimates the total acres of soil disturbance caused by implementing the proposed alternatives. Table SOILS-5 estimates the acres of soil disturbance by VCU and by alternative. Reduced soil productivity resulting from accelerated soil erosion and mass wasting is discussed in the next section. The following assumptions were used in developing these tables:

- The area at risk of soil disturbance, when averaged over all cable and shovel logging harvest acres, is 10 percent of the harvested area. There is no significant ground disturbance from yarding logs in helicopter-logged units. A zero disturbance figure was used in these units.

- The area disturbed from roads is equal to an average of 37.5 feet on each side of the road center line, or 9.1 acres per mile. This figure includes rock pits, landings, turnouts, and areas where endhaul material is deposited.

Projected total disturbance is greatest with Alternative 6. This corresponds to highest level of disturbance from both roads and harvest units for Alternative 6. Projected total disturbance is least for Alternative 2. This corresponds to the lowest level of disturbance from both roads and harvest units for Alternative 2. Rating of alternatives for projected total disturbance is: 6 greater than 3 slightly greater than 5 greater than 4 greater than 2. Projected disturbance for both roads and harvest units by action alternatives is: 6 greater than 4 greater than 5 slightly greater than 3 greater than 2. Projected disturbance for all alternatives will fall within Soil Quality Standards (FSH 2509.18; FSM 2554 R10 Supplement 2500-92-1) with implementation of prescriptions on unit cards (Appendix J).

The projected disturbance for roads, harvest units, and total for VCUs would be greatest in VCU 679 for all action alternatives. Projected disturbance for both units and roads is second greatest in VCU 681 for Alternatives 2, 3, and 6, second greatest in VCU 682 for Alternative 4, and second greatest in VCU 678 for Alternative 5. Alternative 2 will not impact VCUs 674, 677, and 678, and will have minimum impact in VCU 682. Alternative 3 will not impact VCU 677, and will have minimum impact in VCU 674. Alternative 4 will impact all VCUs, but impact will be minimal in VCUs 674, 677, and 680. Alternative 5 will impact all VCUs, but impact will be minimal in VCUs 677 and 682. Alternative 6 will impact all VCUs.

Table SOILS-4

Total Acres of Soil Disturbance from Timber Harvest and Roads* by Alternatives on National Forest System Lands on the Chasina Project Area

		Alternatives					
	Existing	2	3	4	5	6	2040**
Acres of Soil Disturbed	404	221	535	463	520	983	3,007

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

* Roads include rock pits, landings, turnouts, and endhaul areas.
* * Assumes harvest primarily by cable systems.

Table SOILS-5
Potential Acres of Soil Disturbance Resulting from Timber Harvest (TH) and Construction of Roads (RD) by VCU and by Alternative on National Forest System Lands on the Chasina Project Area

	Existing Acres		Alt. 2 Acres		Alt. 3 Acres		Alt. 4 Acres		Alt. 5 Acres		Alt. 6 Acres		2040*	
VCU	TH[1/]	RD[2/]	TH	RD	TH	RD	TH	RD	TH	RD	TH	RD	TH	RD
674	0	0	0	0	2	11	2	0	14	23	14	24	6	1
677	22	0	0	0	0	0	3	5	3	5	6	23	287	43
678	43	0	0	0	16	42	16	0	16	42	18	42	691	103
679	128	144	47	61	82	137	136	191	130	216	159	243	836	125
680	28	0	15	22	17	23	3	2	10	20	27	49	364	54
681	36	0	41	34	41	90	35	12	8	22	67	140	427	64
682	3	0	1	0	15	59	38	20	1	10	42	129	5	1
Total	**260**	**144**	**104**	**117**	**173**	**362**	**233**	**230**	**182**	**338**	**333**	**650**	**2,616**	**391**

Source: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

1/ TH includes acreage within harvest units that may experience reduced soil productivity following harvest activities.
2/ RD includes acreage of soils removed from productivity due to roads and associated activities.

* Assumes harvest primarily by cable systems.

Timber harvest activities can affect soil productivity by influencing drainage characteristics. Inadequate suspension or shovel operations can redirect subsurface drainage and channelize flow. Evapotranspiration may be decreased until forest vegetation is reestablished. There could be a temporary increase in soil moisture. Road fills and cuts can disrupt natural drainage patterns. Localized changes may occur in soil drainage. Drainage could increase or decrease, depending on the site and type of construction activity.

Altered soil drainage can be minimized by adequate yarding, and by proper road design and installation of adequate drainage structures. Altered drainage is likely to occur in an extremely small portion of managed forest lands, and therefore, it is not considered a significant impact. On low-to-moderate gradient slopes, some soil disturbance may even promote a freer draining microsite.

Soil compaction is the increase in soil bulk density and decrease in porosity resulting from repeated operation of heavy equipment. Compaction of the soil can prevent tree roots from penetrating the soil and taking up nutrients. Compaction can also reduce the capability of the soil to absorb and transmit water. Soil puddling occurs when equipment operates on wet

ground, creating ruts or deep tracks that hold water. Both compaction and puddling are more likely to occur in fine silty soils, organic soils, and under saturated conditions.

Soil compaction may occur when machinery runs over the same trail numerous times, such as with shovel logging systems. It may also occur when trees are yarded with ground lead or one-end suspension. Adherence to BMPs can reduce the potential for soil compaction and puddling.

Mass Movement

Timber harvest and road construction have the potential to accelerate the rate of mass movement over natural conditions. Mass movements (landslides) are the dominant erosional processes on steep slopes, and their frequency of occurrence and soil movement rates are increased by logging and road construction (Swanson et al. 1987, cited in Harza 1995). Swanston and Marion (1991) reported a 3.5 times increase in landslides on harvest areas over unharvested areas. They further noted, however, that as a general rule, landslides in harvest areas are significantly smaller, occur at lower elevations, develop on gentler gradients, and tend to travel shorter distances.

Timber harvest may increase the potential for landslides by decreased evapotranspiration and increased soil moisture, loss of root strength, windthrow of adjacent trees, and removing the surface organic layer and exposing mineral soil. Tree roots have a stabilizing effect on soil stability because the roots create an interconnected network that provides lateral strength within the soil mantle. Tree roots may also anchor the soil mass when they penetrate cracks in the bedrock or compact till. After trees are cut, roots tend to decrease in strength 3 to 5 years after harvest, resulting in an increased likelihood of soil mass movement on steep slopes (Swanston 1969, cited in Harza 1995). Windthrow along proposed harvest unit boundaries may also lead to increased mass movement.

Construction of roads and landings, and excavation of rock pits may increase the potential for landslides by the above means, but the potential is greater by cuts on the uphill slopes, placing fill on the downhill slopes and blasting. Activities such as blasting, excavating, and side casting change the load stress on slopes. Roads may also accelerate the frequency of landslides by re-directing or accumulating water, creating increased pore water pressure and shear stress on unstable slopes.

The soil mass movement index (MMI) developed for the Ketchikan Area rates the relative potential for soil mass movement to occur. Tables SOILS-6 through SOILS-9 show the acres of harvest and road construction on low, moderate, high, and very high MMI soils by VCU and alternatives. Soils rated very high have the greatest potential for mass movement. Both very high and high rated soils are given extra consideration when planning timber harvesting operations. Operations allowed and mitigation measures may differ, however, on the two groups of soils. Very high MMI soils are removed from the suitable timber base and are not harvested. Roads may cross very high MMI soils, but extra precautions, like full bench and endhaul, are implemented. Timber harvest on high MMI soils must have at least partial suspension. Roads on high MMI soils have extra protection, which may include full bench and additional drainage structures.

Harvest units field reviewed have been adjusted so that no very high MMI soils are harvested. GIS data does not show this update. Potential impact in harvest units by alternatives is: 6 greater than 4 slightly greater than 3 much greater than 2 slightly greater than 5. Potential

impacts to very high MMI soils is greatest in VCU 679 for Alternatives 2 and 5, and VCU 682 for Alternatives 3, 4, and 6 (Table SOILS-9). Update of the GIS information will be done for the final EIS.

Road construction may occur on very high MMI soils. Alternative 2 is not shown impacting very high MMI soils. Alternatives 3 through 6 are shown impacting five or less acres by roads. Alternative 3 is shown impacting these soils in VCUs 679 and 682. Alternative 4 may impact these soils in VCU 679. Alternative 5 may impact these soils in VCUs 678 and 679. Alternative 6 may impact these soils in VCUs 678, 679, and 682 (Table SOILS-9).

In the planning process, soils rated very high mass movement potential are removed from areas affected by timber harvesting operations. This is generally successful for units because boundaries can more easily be adjusted. Placement of roads is not always so easily adjusted because of limitations of topography and needed access.

Ranking of alternatives for acres of timber harvest on high MMI soils is: 6 much greater than 4 slightly greater than 5 greater than 3 greater than 2. Timber harvest under Alternative 2 is mostly in VCU 679, with some in VCU 681. Impacts under Alternative 3 are greatest in VCU 679, second greatest in VCU 678, and third greatest in VCU 682. Impacts under Alternative 4 are greatest in VCUs 678 and 679, and third greatest in VCU 682. Impacts under Alternative 5 are greatest in VCU 679, second greatest in VCU 678, and third greatest in VCU 674. Impacts under Alternative 6 are greatest in VCU 678, second greatest in VCU 679, and lesser in VCUs 682, 674, 681, and 677 (Table SOILS-8).

Ranking of alternatives for acres of road construction on high MMI soils is: 6 much greater than 5 greater than 3 greater than 4 greater than 2. Impacts under Alternative 2 are limited to VCU 679. Impacts under Alternative 3 are greatest in VCU 678, second greatest in VCU 679, and third greatest in VCU 682. Impacts under Alternative 4 are greatest in VCU 679. Impacts under Alternative 5 are greatest in VCU 679, second greatest in VCU 678, and third greatest in VCU 674. Impacts under Alternative 6 are greatest in VCU 679, second greatest in VCU 682, third greatest in VCU 678, and lesser in VCUs 674 and 681 (Table SOILS-8).

Table SOILS-6
Acres of Timber Harvest (TH) and Road Construction (RD) on Low MMI Soils on Inventoried National Forest System Lands on the Chasina Project Area

	Existing Acres		Alt. 2 Acres		Alt. 3 Acres		Alt. 4 Acres		Alt. 5 Acres		Alt. 6 Acres	
VCU	TH	RD	TH	RD	TH	RD	TH	RD	TH	RD	TH	RD
674	0	0	0	0	0	0	0	0	7	0	7	0
677	34	0	0	0	0	0	0	0	0	0	5	< 1
678	78	0	0	0	61	0	61	0	0	0	78	0
679	328	62	175	44	189	59	271	86	279	84	333	94
680	123	0	135	22	136	23	0	0	82	20	146	27
681	65	0	170	27	170	32	110	10	72	17	212	39
682	10	0	0	0	0	9	14	5	6	4	46	22
Total	**638**	**62**	**480**	**93**	**556**	**123**	**456**	**101**	**446**	**125**	**827**	**183**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table SOILS-7
Acres of Timber Harvest (TH) and Road Construction (RD) on Moderate MMI Soils on Inventoried National Forest System Lands on the Chasina Project Area

	Existing Acres		Alt. 2 Acres		Alt. 3 Acres		Alt. 4 Acres		Alt. 5 Acres		Alt. 6 Acres	
VCU	TH	RD	TH	RD	TH	RD	TH	RD	TH	RD	TH	RD
674	0	0	0	0	0	0	0	0	11	0	11	0
677	2	0	0	0	0	0	2	1	2	1	35	16
678	97	0	0	0	47	8	47	147	47	8	52	8
679	824	67	280	73	573	139	706	0	653	156	882	190
680	145	0	15	0	15	0	27	2	0	0	105	20
681	99	0	70	6	70	27	159	1	10	5	253	48
682	3	0	1	0	51	27	182	9	1	3	184	61
Total	**1,170**	**67**	**366**	**73**	**756**	**201**	**1,123**	**160**	**724**	**173**	**1,522**	**343**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table SOILS-8

Acres of Timber Harvest (TH) and Road Construction (RD) on High MMI Soils on Inventoried National Forest System Lands on the Chasina Project Area

	Existing Acres		Alt. 2 Acres		Alt. 3 Acres		Alt. 4 Acres		Alt. 5 Acres		Alt. 6 Acres	
VCU	TH	RD	TH	RD	TH	RD	TH	RD	TH	RD	TH	RD
674	0	0	0	0	18	11	26	0	120	24	128	24
677	19	0	0	0	0	0	29	3	29	3	101	7
678	245	0	0	0	115	32	262	0	260	32	430	32
679	77	14	135	21	155	23	262	51	289	52	304	54
680	0	0	0	0	16	<1	0	0	16	1	16	2
681	1	0	44	0	44	5	45	0	0	0	117	20
682	17	0	0	0	70	21	165	6	3	3	165	42
Total	**359**	**14**	**179**	**21**	**418**	**92**	**789**	**60**	**716**	**115**	**1,261**	**181**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Table SOILS-9

Acres of Timber Harvest (TH) and Road Construction (RD) on Very High MMI Soils on Inventoried National Forest System Lands on the Chasina Project Area

	Existing Acres		Alt. 2 Acres		Alt. 3 Acres		Alt. 4 Acres		Alt. 5 Acres		Alt. 6 Acres	
VCU	TH	RD	TH	RD	TH	RD	TH	RD	TH	RD	TH	RD
674	0	0	0	0	0	0	0	0	0	0	0	0
678	23	0	0	0	0	0	0	0	0	0	1	0
678	11	0	0	0	0	0	0	0	0	2	10	2
679	0	1	3	0	0	2	3	1	3	1	3	1
680	0	0	0	0	0	0	0	0	0	0	0	0
681	0	0	2	0	2	0	2	0	0	0	8	0
682	3	0	0	0	30	2	34	0	0	0	34	2
Total	**37**	**1**	**5**	**0**	**32**	**4**	**39**	**1**	**3**	**2**	**56**	**5**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996.

Landslides

Swanston and Marion (1991) investigated the occurrence of landslides on forested terrain on the Tongass National Forest for the period between 1963 and 1983. This period bridged the development of large-scale clearcutting in Southeast Alaska. Slides inventoried were greater than 100 cubic yards in initial failure volume. A total of 1,395 landslides were identified. A little over 7 percent, 103 occurred in clearcut areas or were directly associated with timber harvesting. Fifteen landslides (about 1 percent) were associated with road construction, but were not used in the following calculations. A little over 91 percent of the slides occurred in uncut areas. The rate of occurrence of landslides was about three and one-half times greater on harvested (2.127×10^{-5} landslides/acre/year) versus uncut (6.2285×10^{-6} landslides/acre/year/) lands. Swanston and Marion noted that as a general rule, landslides are significantly smaller in harvest areas. Extrapolating from data presented in this paper, an estimate of the average size of slides is 0.99 acre in harvest areas, and 2.03 acres in uncut areas.

An estimation of the number of slides greater than 100 cubic yards in size on forested lands for 20 years following this project, and the acreage affected by these slides, is shown in Table SOILS-10.

It is assumed that the Chasina Project Area is representative of the terrain included in the study by Swanston and Marion, and that the study period represents climatic conditions that will continue into the future. It is estimated that one landslide will occur on harvested lands under both Alternatives 1 (existing condition) and 2. Two landslides are estimated under Alternatives 3, 4, and 5. Three landslides are estimated under Alternative 6. Five landslides are estimated on uncut lands for all alternatives. Number and acreage of landslides is estimated to be greater on uncut than on harvested lands for all alternatives. These values do not include estimations for landslides attributable to construction of roads, the numbers and acres of which could be comparable or greater than those from timber harvest.

Table SOILS-10

Estimated Occurrence and Acreage of Landslides* by Alternative for 20-year Period Following Harvest on National Forest System Lands on the Chasina Project Area

	Existing		Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt. 6	
	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres
Harvested	1.1	1.1	1.6	1.6	1.9	1.9	2.3	2.3	2.0	2.0	2.8	2.8
Uncut	5.2	10.5	5.0	10.2	4.9	10.1	4.8	9.8	4.9	10.0	4.7	9.5
Total	**6.3**	**11.6**	**6.6**	**11.8**	**6.8**	**12.0**	**7.1**	**12.1**	**6.9**	**12.0**	**7.5**	**12.3**

SOURCE: Swanston 1991, USDA-Forest Service, Ketchikan Area GIS Data Base 1996

* Slides greater than 100 cubic yards.

Surface Erosion

Timber harvest and road construction have the potential to accelerate the amount of surface erosion over natural conditions. Road and landing construction, rock pit development, and yarding may increase surface erosion by exposing mineral soil.

Due to the considerable amount of vegetative ground cover remaining within harvest units during and after timber harvest, surface erosion (including sheet, rill, and gully erosion) should be limited. Surface erosion could occur if operations expose mineral soil, or if equipment and yarding causes trenches which concentrate water runoff.

Surface erosion is more likely to occur on exposed road surfaces and cut surfaces. Roads in the project area are constructed with blasted quarry rock. Vehicular traffic breaks down the surface material into fine particles. The amount of sediment produced is a function of the type of rock, and the type and amount of traffic. Sediment from cut and fill slopes, borrow pits, and rock pits can be minimized if exposed soil is seeded following construction. Surface runoff during precipitation events and snowmelt transports sediment to drainage ditches. Ditches and culverts that flow into streams may result in increased turbidity.

Lacking quantitative estimates of sediment yield from road surfaces in Southeast Alaska, the best evaluation of potential surface erosion from roads is comparison of the miles of open and closed roads. Roads which remain open after harvest activities, and especially those with high traffic levels and heavier loads, have a greater potential for surface erosion than temporary roads that are closed. The Chasina road system is isolated, so traffic use will be less than on roads connected to communities. Planning calls for all roads on National Forest System lands on the project area to be closed to all but administrative use upon completion of the Chasina Project. Rehabilitation work has been specified in the road cards (Appendix J). Miles of road by VCU and alternative is used as a general evaluation of potential sediment yield (Table SOILS-11). This evaluation does not account for different soils that roads are built on, nor for differences in where drainage runs off these roads. Potential problems with sedimentation from roads is further discussed in the Aquatic Resources section in Chapter 3.

Table SOILS-11
Miles of Existing and New Road by VCU and Alternative on National Forest System Lands on the Chasina Project Area

VCU	Existing	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
674	0	0	1.2	0	2.6	2.6
677	0	0	0	0.5	0.5	2.6
678	0	0	4.6	0	4.6	4.6
679	15.8	15.2	24.3	36.0	37.0	42.1
680	0	2.4	2.6	0.2	2.2	5.4
681	0	3.7	9.9	1.3	2.4	15.4
682	0	0	6.5	2.3	1.1	14.2
Total	**15.8**	**21.3**	**49.1**	**40.3**	**50.4**	**86.9**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996

Surface erosion based on miles of road is estimated to be greatest for Alternative 6, much less for Alternative 5, slightly less for Alternative 3, less for Alternative 4, less for Alternative 2, and least for existing condition (Table SOILS-11). This ranking can also be shown by road density, which is miles of road per square mile of area. Road densities were computed using existing and new roads. Road densities for the alternatives are: 1.52 (Alternative 6), 0.98 (Alternative 5), 0.96 (Alternative 3), 0.83 (Alternative 4), 0.55 (Alternative 2), and 0.23 (existing condition). VCU 679 may be more affected by surface erosion because it will have the greatest miles of roads under all alternatives and has the only roads in the existing condition. VCU 677 will have the least amount of surface erosion based on miles of road for all alternatives and existing condition. These calculations are only for roads on National Forest System lands. They do not account for roads on lands under other ownership that the Forest Service may use, nor the miles of road on VCUs on lands under other ownership. Miles of road by VCU on lands under other ownership include: 677 = 15.1, 678 = 5.8, 679 = 1.4, 680 = 19.3, 681 = 13.4, and 682 = 0.4.

Cumulative Effects

These cumulative effects considers the combined effect of past, present, and future timber harvest activities on soil disturbance, erosion, and mass wasting. Cumulative effects can result from multiple activities that take place on the same site, or the combined effects of activities spread across the landscape. In the Chasina Project Area, timber harvest and related activities have been conducted since the early 1980s. Aside from some limited salvage sales along harvest units and roads, multiple entries have not occurred on the same site, nor are they anticipated to occur within the projected time frame. Therefore, cumulative effects considered here are the combined effect of past, present, and future harvest activities spread throughout the project area, rather than repeated activities on a single site. Cumulative effects are

estimated for all additional lands reviewed but not included in this EIS for harvest activities to 2040.

The effects of road construction, use, and maintenance are the most persistent and constitute the greatest potential for cumulative effects (Geppert, Lorenz, and Larson 1984, cited in Harza 1995). Tables SOILS-12 to SOILS-17 show lands affected prior to implementation of this project (Existing Condition). Table SOILS-13 displays the cumulative acreage affected by road construction on National Forest System lands for each VCU in the project area. Table SOILS-12 displays the cumulative acreage of harvest units on National Forest System lands for each VCU. Although soil disturbance is usually restricted to less than 15 percent of an activity area, total harvested acres is used in order to portray the total area affected by management activities in each VCU. Tables SOILS-14 (National Forest System lands) and SOILS-16 (all lands) display the cumulative acreage of harvest units and roads for each VCU. Tables SOILS-15 (National Forest System lands) and SOILS-17 (all lands) display the percentage of each VCU affected by timber harvest and roads.

Cumulative Effects on National Forest System Lands

The following information summarizes the cumulative effects on National Forest System lands within VCUs on the project area. VCU 679 has the greatest acreage currently affected by both harvest units and roads (Tables SOILS-12 to SOILS-14). VCU 679 will also have the greatest acreage affected by both harvest units and roads for all alternatives. The greatest impact to VCU 679 would be under Alternatives 4, 5, and 6, where 20 percent of the VCU would be affected by timber harvest and roads (Table SOILS-15). Cumulative acreage affected by timber harvest by action alternatives is ranked as 6 much greater than 4 greater than 5 slightly greater than 3 greater than 2 (Table SOILS-12). Cumulative acreage affected by roads by action alternatives is ranked as 6 much greater than 3 slightly greater than 5 greater than 4 greater than 2 (Table SOILS-13). Cumulative acreage affected by both harvest units and roads follows results for timber harvest listed above (Table SOILS-14). This follows because of the greater acreage in harvest units than in roads.

Table SOILS-12
Cumulative Acres by VCU Affected by Timber Harvest on National Forest System Lands: Currently, Following Implementation of Alternatives on the Chasina Project Area, and Possible Additional Harvest to 2040

VCU	Existing	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	2040*
674	0	0	19	26	138	146	84
677	219	219	219	250	250	362	3,092
678	432	432	655	802	739	1,002	7,562
679	1,279	1,872	2,196	2,877	2,859	3,156	10,559
680	276	426	442	303	374	542	4,078
681	356	768	768	744	438	1,098	5,040
682	33	34	185	435	44	470	232
Total	**2,595**	**3,751**	**4,484**	**5,437**	**4,842**	**6,776**	**30,647**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996

* Uses Alternative 3.

Table SOILS-13
Cumulative Acres by VCU Affected by Roads* on National Forest System Lands: Currently, Following Implementation of Alternatives on the Chasina Project Area, and Possible Additional Harvest to 2040

VCU	Existing	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	2040**
674	0	0	11	0	24	24	21
677	0	0	0	5	5	23	430
678	0	0	42	0	42	42	1,077
679	144	205	281	335	360	387	1,534
680	0	22	23	2	20	49	568
681	0	34	90	12	22	140	730
682	0	0	59	20	10	129	66
Total	**144**	**261**	**506**	**374**	**483**	**794**	**4,426**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996

* Assumes the area disturbed from roads, landings, turnouts, endhaul areas, and rock pits is averaged to a road width of 75 feet, for 9.1 acres per mile of road.
** Uses Alternative 3.

Table SOILS-14
Cumulative Acres by VCU Affected by Timber Harvest and Roads* on National Forest System Lands: Currently, Following Implementation of Alternatives on the Chasina Project Area, and Possible Additional Harvest to 2040

VCU	Existing	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	2040**
674	0	0	30	26	162	170	105
677	219	219	219	255	255	385	3,522
678	432	432	697	802	781	1,044	8,639
679	1,423	2,077	2,477	3,212	3,219	3,543	12,093
680	276	448	465	305	394	591	4,646
681	356	802	858	756	460	1,238	5,770
682	33	34	244	455	54	599	298
Total	**2,739**	**4,012**	**4,990**	**5,811**	**5,325**	**7,570**	**35,073**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996

* Assumes the area disturbed from roads, landings, turnouts, endhaul areas, and rock pits is averaged to a road width of 75 feet, for 9.1 acres per mile of road.
** Uses Alternative 3.

Table SOILS-15
Cumulative Percent of VCU Affected by Timber Harvest and Roads* on National Forest System Lands: Currently, Following Implementation of Alternatives on the Chasina Project Area, and Possible Additional Harvest to 2040

VCU	Existing	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	2040**
674	0	0	1.55	1.35	8.39	8.80	5.44
677	2.50	2.50	2.50	2.91	2.91	4.40	40.21
678	2.42	2.42	3.91	4.50	4.38	5.85	48.44
679	8.84	12.91	15.39	19.96	20.00	22.02	25.15
680	4.07	6.60	6.85	4.50	5.81	8.71	68.49
681	2.72	6.12	6.55	5.77	3.51	9.45	44.04
682	0.75	0.77	5.52	10.30	1.22	13.56	6.74
Total	**3.97**	**5.82**	**7.24**	**8.43**	**7.73**	**10.98**	**50.89**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996

* Assumes the area disturbed from roads, landings, turnouts, endhaul areas, and rock pits is averaged to a road width of 75 feet, for 9.1 acres per mile of road.
** Uses Alternative 3.

Cumulative Effects on All Lands

The data noted in the previous paragraph does not give an accurate portrayal of the project area because of the amount of harvest and road construction on lands under other ownership in some VCUs. Comparison of Tables SOILS-14 and SOILS-16 shows a considerable increase in acreage currently affected by harvest units and roads by VCUs for the existing condition when lands under other ownership on the project area are considered. VCU 681 has the greatest acreage affected by harvest units and roads when considering all lands on the project area (Table SOILS-16). The ranking of alternatives for cumulative acreage affected by harvest and roads on all lands is the same as for National Forest System lands noted above because calculations only include acreage the Forest Service plans to affect under these alternatives. VCUs 677, 680, and 681 have greater than 20 percent of their acreage affected under existing harvest and roads on all lands (Table SOILS-17). VCU 681 is greatest with 40 percent affected, and VCU 680 slightly less at 38 percent. Acreage affected increases to greater than 41 percent in VCU 681 and greater than 38 percent in VCU 680 for action alternatives. Additional affected acreage greater than 20 percent by VCU for action alternatives includes: all alternatives for VCU 677, and Alternatives 4, 5, and 6 for VCU 679.

Table SOILS-16

Cumulative Acres by VCU Affected by Timber Harvest and Roads* on All Lands: Currently, Following Implementation of Alternatives on the Chasina Project Area, and Possible Additional Harvest to 2040**

VCU	Existing	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	2040***
674	0	0	30	26	162	170	104
677	1,885	1,885	1,885	1,922	1,922	2,052	5,189
678	485	485	750	855	833	1,097	8,692
679	1,914	2,568	2,971	3,705	3,712	4,036	12,587
680****	2,595	2,766	2,784	2,624	2,713	2,910	6,965
681	5,318	5,765	5,821	5,719	5,423	6,201	10,733
682	37	38	248	459	57	603	302
Total	**12,234**	**12,508**	**14,489**	**15,310**	**14,822**	**17,068**	**44,572**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996

* Assumes the area disturbed from roads, landings, turnouts, endhaul areas, and rock pits is averaged to a road width of 75 feet, for 9.1 acres per mile of road.

** Shows most current harvest and roads on lands under other ownership, and proposed Forest Service roads on these other lands. Does not show future harvest and roads by other owners on other lands.

*** Uses Alternative 3.

**** Roads existing in this VCU were calculated by hand as they were not entered in GIS Data Base 1996.

Table SOILS-17

Cumulative Percent of VCU Affected by Timber Harvest and Roads* on All Lands: Currently, Following Implementation of Alternatives on the Chasina Project Area, and Possible Additional Harvest to 2040**

VCU	Existing	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	2040***
674	0	0	1.5	1.3	8.4	8.8	5.4
677	21.5	21.5	21.5	21.9	21.9	23.4	59.2
678	2.7	2.7	4.2	4.8	4.7	6.2	48.7
679	11.9	16.0	18.5	23.0	23.1	25.1	78.2
680****	38.3	40.8	41.0	38.7	40.0	42.9	100
681	40.6	44.0	44.4	43.6	41.4	47.3	81.9
682	0.8	0.9	5.6	10.4	1.3	13.6	6.8
Total	**17.8**	**18.1**	**21.0**	**22.2**	**21.5**	**24.8**	**64.7**

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996

* Assumes the area disturbed from roads, landings, turnouts, endhaul areas, and rock pits is averaged to a road width of 75 feet, for 9.1 acres per mile of road.

** Shows most current harvest and roads on lands under other ownership, and proposed Forest Service roads on these other lands. Does not show future harvest and roads by other owners on other lands.

*** Uses Alternative 3.

**** Roads exist on lands under other ownership, but are not entered on USDA-Forest Service, Ketchikan Area GIS Data Base 1996, and are not included here.

Data in Tables SOILS-16 and SOILS-17 still underestimates lands affected under other ownership. Lands affected under other ownership are only shown for the existing condition. Harvest and roading is continuing on these lands. The most recently affected lands have not been entered into the GIS data base. This includes lands in VCUs 674 and 678. Some lands with recent harvest and roading in VCU 674 are outside the area of this project, and would not be included in the analysis for this project. Roads on lands under other ownership in VCU 680 have not been included in the GIS data base, but were calculated by hand. Plans by other owners for future harvest are not known and could not be entered into these calculations. Thus, estimations for cumulative acres affected (Table SOILS-16) and cumulative percent of VCUs affected (Table SOILS-17) on all lands on the project area do not include adjustments for other owners on other lands for any of the alternatives, nor for 2040.

Affected acreage in the smaller divisions of watersheds within VCUs may be of greater concern than the acreage affected in the larger areas covered by VCUs. Table AQU-9 displays percent harvest in select watersheds on the project area. These figures are only for harvest units. They do not include the additional disturbance from roads for this harvest. Watersheds now exceeding 25 percent harvest include: E92A (26 percent, VCU 680), E94A (64 percent, VCU 680), H27A (61 percent, VCU 678), H38A (48 percent, VCU 677), H54A

(53 percent, VCU 681), and H63A (39 percent, VCU 679). All but watershed H38A will have additional acreage harvested under some alternatives under this project. Watershed H62A (VCU 679) is currently 13 percent harvested. Harvest under all action alternatives will exceed 25 percent. Watershed H59A (VCU 679) is currently 8 percent harvested. Harvest under Alternatives 2 and 6 will equal or exceed 25 percent.

Projecting disturbance to a point in the future beyond the life of this project was done. This calculation assumes that all lands suitable and available for harvest as identified by the TLMP Draft Revision (1991a), and not previously harvested, nor harvested under Alternative 3 of the Chasina Project, will be harvested by 2040. This projection still shows that the greatest acreage affected by harvest units, roads, and total of harvest units and roads will occur in VCU 679 on National Forest System lands (Tables SOILS-12 to SOILS-14). The greatest acreage affected by the total of harvest units and roads on all lands will also occur in VCU 679 (Table SOILS-16).

Mitigation Measures

Forest Plan Standards and Guidelines are designed to minimize accelerated soil erosion and to maintain the inherent long-term soil productivity within the levels of the Soil Quality Standards (FSH 2509.18; FSM 2554, R10 Supplement 2500-92-1). The minimum soil quality standard requires that 85 percent of an area be maintained in a condition of acceptable productivity for trees and other managed vegetation following land management activities. A minimum percentage of ground cover is also required to be maintained: the effective ground cover must be at least 85 percent on slopes less than 35 percent, 90 percent on slopes from 35-75 percent, and 95 percent on slopes greater than 75 percent.

Implementation of Best Management Practices (BMPs) can further reduce impacts to soils (FSH 2509.22). BMPs to protect soil during timber harvest include limiting the operating period of timber sale activities to avoid wet soil conditions (BMP 13.4), avoidance of unstable areas (BMP 13.5), protection of wetlands during harvest (BMP 12.5), proper log landing location and design for erosion control (BMP 13.10), revegetation of areas disturbed by harvest activities (BMP 12.17), and type of yarding on different soil conditions to reduce soil disturbance (BMP 13.9).

BMPs have also been developed to minimize erosion related to road construction, use, and maintenance. These include construction, revegetation, and stabilization to minimize erosion (BMPs 12.17, 14.5), timing restrictions (BMP 14.6), slope stabilization measures to minimize mass failures (BMPs 13.5, 14.7), minimize surface erosion (BMP 14.8), control of road drainage (BMP 14.9), pioneer road construction guidelines (BMP 14.10), control of excavation and sidecast material (BMP 14.12), minimize sediment during operations on waterways (BMPs 14.14, 14.17), development of rock pits (BMP 14.18), maintenance of roads (BMP 14.20), and obliteration of temporary roads (BMP 14.24).

These BMPs are designed to reduce erosion caused by timber harvest and road construction use and maintenance. They apply to all harvest units and roads proposed for all alternatives in the Chasina Project Area. Implementation of BMPs should result in a reduction of the acreage of soil disturbance displayed in Tables SOILS-9 and SOILS-10.

Specific mitigation measures for harvest units and road locations with special concerns are described on the harvest unit and road design cards (Appendix J).

All potential units were reviewed in the office using inventory and GIS information. Units with potential concerns were identified and prioritized for field review. Due to time constraints, not all harvest units were field reviewed for soil and watershed concerns. Units in Old-growth Habitat Reserves were given a low priority for review. Review of roads for soil and watershed concerns was primarily an office review using inventory and GIS information. Portions of some roads were reviewed. These were primarily portions in harvest units that were field reviewed. Most roads were located in the field only to the extent of identifying that a road was feasible.

Monitoring

The Forest Plan recognizes three distinct types of monitoring: implementation, effectiveness, and validation. Implementation monitoring determines if projects and activities comply with Forest Plan Standards and Guidelines. Effectiveness monitoring determines whether the standards and guidelines achieve the desired results. Validation monitoring determines whether the assumptions in the Forest Plan regarding the relationship between management actions and their effects are correct, or if there is a better way to depict these relationships.

A monitoring plan has been developed for the Tongass National Forest by the Forest Planning Team and is described in the TLMP Draft Revision (1991a). In accordance with the 1992 Memorandum of Agreement between the Alaska Department of Environmental Conservation and the USDA-Forest Service Alaska Region, the Forest Service performs annual BMP implementation and effectiveness monitoring. The Chasina Project Area will be part of the Forest Plan monitoring, and the Ketchikan Area Monitoring Strategy.

Project-specific monitoring that is unique to the Chasina Project Area, and that would not be included in regular Forest Plan or routine implementation monitoring, has been identified for several resources. Project-specific monitoring is not planned for soil resources in the Chasina Project Area.

Geology, Minerals, and Karst Resources

Key Terms

Cave—any naturally occurring void, cavity, recess, or system of interconnected passages which occurs beneath the surface of the earth or within a cliff or ledge and which is large enough to permit an individual to enter.
Cave Resources—any material or substance occurring in caves such as animal life, plant life, paleontological resources, cultural resources, sediments, minerals, speleogens, and speleothems.
Doline or Sinkhole—bowl- or funnel-shaped depressions ranging in diameter from a few to more than 3,000 feet, and from about 10 to 300 feet in depth. Sinkholes originate primarily either by solution from the surface downward or by collapse in solution cavities at depth.
Grike—solution-widened joints, faults, and/or bedding contacts in a karst area.
Insurgence—point at which a stream flows into the ground.
Epikarst—the upper surface of the karst, including the upper percolation zone through which surface waters enter the karst hydrologic system and in which most dissolution of the carbonate takes place.
Karst—a type of topography that develops in areas underlain by soluble rocks, primarily limestones. Dolines, collapsed channels, vertical shafts, and caves are formed when the subsurface layer dissolves. Areas on which karst has developed are said to display "karst topography" or are referred to as a "karst landscape".
Karst Lands—the areas found atop carbonate rock within which karst has developed, and including the watersheds that contribute surface flow to karst.
Karst Landscape—an ecological unit found atop carbonate bedrock on which karst has developed, and including the recharge areas on adjacent noncarbonated substrate. A few of the characteristics of this ecological unit include: older, well-developed spruce and hemlock forests, increased productivity for plant and animal communities, extremely productive aquatic communities, well-developed subsurface drainage, and underlying unique cave resources.
Resurgence—point at which an underground stream reaches the surface and begins flowing above ground.
Runnels—solution channels carved by water into bedrock, either on flat or inclined surfaces.
Skarn—a term generally reserved for rocks composed mostly of lime-bearing silicates, derived from nearly pure limestones into which large amounts of silicon, aluminum, iron, and magnesium have been introduced.
Speleogen—relief features on the walls, ceiling, and floor of any cave or lava tube which are part of the surrounding bedrock.
Speleothem—any natural mineral formation or deposit occurring in a cave or lava tube, including but not limited to any stalactite, stalagmite, cave flower, flowstone, concretion, or formation of clay or mud.

Affected Environment

Introduction

This section provides a view of the regional geologic features and parameters that influence the mineral and karst resources of the Chasina Project Area. Key elements of these geologic features are the lithology and structures that control the mineral deposition and development of the karst lands of the region.

Geologic Setting

The Chasina Project Area is predominately underlain by pre-Ordovician Wales Group rocks of the Alexander terrain. The Wales Group lithologies stretch across the project area in distinct fault displaced blocks trending northwest . The Wales Group dominate rock types are schist and phyllite interbedded with limestone and slate, limestone, and greenstone (Condon 1962, Herreid et al. 1978, Hedderly-Smith 1993). Contacts are gradational, with interbedding of the dominant rock types. The Wales Group is strongly metamorphosed showing intense folding and foliation, having undergone greenschist-facies metamorphism. The limestone has commonly metamorphosed to marble. This marble is a distinctive unit of the Wales Group (Herreid et al. 1978). Most of the marble is very light to medium-gray fine grained crystalline rock that weathers medium gray. The marble, almost blue in appearance, is intensely folded and sheared. Locally the marble's color varies from the bluish hues to pink, tan, or flesh colors.

The peninsula south of Port Johnson consists of slightly metamorphosed volcanic and sedimentary rocks of the Silurian to Ordovician Descon Formation. Wales Group rocks are more severely deformed than the stratified Descon Formation rocks. Chasina Point is underlain by Mesozoic or Paleozoic Byron Lake intrusive complex consisting of diorite, granodiorite, and quartz monazite (Condon 1962, Mass et al. 1995, Hedderly-Smith 1993).

Rock units have been offset by major northwest- trending faults, moving the blocks to their present location where they have been subsequently glaciated, weathered, and eroded. The most important structural feature in the project area is the doubly-plunging anticline (dome) oriented east-west and centered on Paul Lake (Mass et al. 1995).

Mineral Setting

Southern Prince of Wales Island, in which the project area is located, has experienced extensive mineral exploration and production activities since the initial discoveries in 1897. Within the Chasina Project Area are two separate areas of mineralization; the Dolomi Area and the South Arm Cholmondeley Area. Mineralization within the Dolomi Area can be divided into three types: (1) conformable, low-sulfide, gold-bearing quartz veins that are brecciated and locally contain marble; (2) unconformable, low-sulfide, gold-bearing quartz veins; and (3) conformable, copper-gold-bearing, quartz-marble breccia zones (Maas et al. 1995). Marble and calcareous schist either host or are adjacent to the various mineral deposits found within the South Arm Cholmondeley Area.

During field investigations by the U. S. Bureau of Mines (BOM) during the summer of 1990, 30 mines, prospects, or occurrences were located within the Chasina Project Area (Maas et al. 1991). The following is a summary of those findings. Figure GEO-1 shows the location of the mine, prospect, or occurrence. Please refer to Mass et al. for specific deposit and analysis information.

Dolomi Area

Equator (1)

The Equator prospect is one mile northeast of Lancaster Cove at an elevation of 360 feet. According to a 1908 report by Wright and Wright it consists of a 50-foot tunnel driven on a 3-foot wide quartz vein containing chalcopyrite and pyrite. Gold and copper were recovered from this vein during BOM sampling.

Dolomi Area (2)

Seventeen samples were collected from a variety of locations in the Dolomi Area by the BOM. Mineralized zones and quartz veins were tested and samples worth noting are discussed.

Roy Creek (3)

The Roy Creek Veins are 8.5 miles north of Dolomi via logging roads and were discovered by Sealaska geologists in 1988. There are two quartz-pyrite-chalcopyrite veins in road cuts within chlorite-schist greenschist. Gold, silver, and copper were recovered from these veins during BOM sampling.

7-Mile Gold (4)

The 7-Mile Gold Prospect is 7 miles by logging road north of Dolomi and was discovered by Sealaska geologists in 1988. The prospect consists of a silicified limestone-marble breccia zone containing pyrite-chalcopyrite clots hosted in altered limestone. Gold, silver, and copper were recovered from these veins during BOM sampling.

Kael Pit (5)

The Kael Pit is a borrow pit located along a USFS road 1.25 miles from Lancaster Cove. Gold-copper mineralization was discovered at this pit by Sealaska geologists in 1988. Until October 1995, Sealaska Corporation maintained claims on this prospect. Those claims have been relinquished. Gold and copper were recovered from these silicified marble breccia zones during BOM sampling.

Croesus (6)

The Croesus Prospect is one mile northeast of the south end of Kitkun Bay. Wright described this prospect as consisting of two tunnels driven along a quartz vein. The vein is hosted in marble with thin interbeds of greenstone. The ruggy crystalline quartz vein yielded gold during BOM sampling.

San Juan (7)

The San Juan Prospect is 0.5 miles northwest of the corner of Kitkun Bay. The prospect was discovered in 1899 (Brooks 1902). By 1908 (Wright and Wright 1908), the prospect is described as consisting of a tunnel at 500 feet elevation and a second tunnel above that. BOM investigations found an adit at 680 feet elevation, a caved shaft and quartz dump, a caved portal at an elevation of 580 feet and a trench. The upper adit exposes a shear zone in limestone with interbedded schist. This shear zone yielded gold during BOM sampling.

Golden Fleece (8)

The Golden Fleece Mine is one mile north of the abandoned town of Dolomi near the inlet to James Lake. It was discovered in 1899 (Brooks 1902) and by 1902, the deposit was developed with two drifts and several shafts, a mill, and a tram connecting the mine to the town of Dolomi. Gold was produced up to 1922, from quartz lenses within marble. Samples

were collected across quartz and quartz-marble breccia zones in two adits in 1990, and gold was recorded from the samples.

Alpha (9)
The Alpha Prospect is 0.5 miles east of the north end of James Lake. Wright reports a quartz vein hosted in banded limestone and a shaft and open cuts. The BOM sampled pyrite-chalcopyrite-rich quartz from a dump and quartz-marble veins. These samples yielded gold and copper.

Valparaiso (10)
The Valparaiso Mine is on the north side of Paul Lake. It was discovered in 1899, and consists of a quartz vein hosted in limestone. The deposit was mined sporadically between 1900 and 1993. The BOM sampled within several levels of the mine from the quartz vein and gold was recovered.

Paul Lake (11)
The Paul Lake Prospect is on the north side of Paul Lake about 2,000 feet easterly from the Valparaiso shaft. The prospect is developed in a quartz vein similar to the vein at the Valparaiso Mine. The BOM sampled the vein which contained sparse pyrite, chalcopyrite, galena, sphalerite, malachite, azurite, and limonite. Samples yielded gold, silver, copper, lead, and zinc.

Moonshine (12)
The Moonshine Prospect is near a small stream that forms the outlet to James Lake. The prospect was reported to consist of two adits and surface cuts that expose quartz veins and quartzite that contain native gold. The veins are hosted in schist and limestone. BOM investigations revealed an open cut and two adits exposing quartz veins hosted in interbedded calcareous schist and gray marble. The samples taken from these veins yielded gold.

Amazon (13)
The Amazon Prospect is 0.3 miles east of Paul Lake. It consists of a 123-foot-deep shaft and associated drift. The workings expose a quartz vein hosted in calcareous schist. BOM sampling of the dump, rubble at the shaft, and a vein exposed near the shaft yielded gold.

Boston (14)
The Boston Prospect is along the eastern side of Amazon Lake and consists of three inclined shafts, a caved adit, and some cuts and trenches. The BOM was able to find the trenches and sampled quartz veins hosted in calcareous schist and gray limestone. The samples yielded gold, silver, and copper.

Jumbo (15)
The Jumbo Prospect is hundreds of feet west of a small creek that joins James and Amazon Lakes. Though a shaft following a gold-bearing quartz-breccia vein hosted in phyllite was reported (Brooks 1902) the BOM investigations could not find it. Investigations revealed an adit and samples taken from a quartz-marble breccia vein yielded gold.

Stockton Quartz (16)
The Stockton Quartz Prospect is on the west side of Dolomi Bay. BOM investigations revealed a shaft with a small dump of quartz and greenstone blocks. Samples contained little gold.

Moss Point (17)
Moss Point Prospect is near Moss Point on the south shore of Port Johnson. It consists of a limonite-stained phyllite with disseminated pyrite. A 20-foot-long adit was located at an elevation of 365 feet within the pyrite-bearing zone. Samples were taken from the beach to within the adit. These samples yielded gold and copper.

South Arm and Dora Bay (18)
Reconnaissance samples were collected at four locations between South Arm and Dora Bay. They did not contain significant metal values.

Borrow Pits (19)
Samples of pegmatite dike-veins and quartz veins were collected from borrow pits 3 and 4.5 miles southerly along the road from the Cholmondeley logging camp of Dora Bay. These samples yielded gold, zinc, uranium, cerium, lanthanum, and yttrium.

Dora Lake Narrows (20)
The Dora Lake Narrows occurrence is on the west side of Dora Lake Narrows and consists of dike-veins containing columbium, uranium, yttrium, zirconium and other rare earth elements.

Borrow Pit (21)
A borrow pit 0.5 miles west of the Lucky Boy Prospect consists of calcareous metasediments and greenstone with quartz-calcite-sulfide-bearing veins and stringers. Samples taken from various mineralized zones within the pit yielded gold, silver, lead, and zinc.

North Lucky Boy (22)
The North Lucky Boy Prospect is on the east slope of the south end of Dora Lake. Geologically similar to the Lucky Boy Prospect, it consists of quartz-calcite veins containing pyrite, sphalerite, galena, and chalcopyrite. BOM investigations found several trenches and cuts but not a reported adit. Samples taken from the quartz calcite veins within the area yielded gold, silver, copper, lead, and zinc.

Lucky Boy (23)
The Lucky Boy Prospect, in the pass between Dora Lake and Miller Lake, was developed between 1902 and 1917. It consists of a quartz-calcite-breccia vein hosted in schist and some limestone. The underground workings and trenches were sampled by the BOM. Samples taken from the quartz calcite veins within the area yielded gold, silver, copper, lead, and zinc.

Borrow Pit (24)
A borrow pit 0.2 miles north of Miller Lake consists of metasediments with concordant quartz-calcite veins. Samples taken from the quartz-calcite veins within the pit yielded gold and copper.

Cymru (25)
The Cymru Mine is near the end of Miller Lake on the north side of its outlet on North Arm. It consists of quartz-calcite veins bearing pyrite and chalcopyrite hosted in marble with interbedded chlorite schist. It was discovered in 1899, and by 1909, workings consisted of a couple shafts, two adits, and deep trenches. By 1928, most of the surface improvements were in poor condition or had disappeared altogether (Bufvers 1967). BOM investigations sampled from the underground workings and trenches. Samples taken from the prospect yielded silver, copper, gold, lead, and zinc.

North Arm Marble (26)
Eleven limestone claims (MS 728) are located on the North Arm near its head. Maps of these claims dated 1906, show a quarry, a tramway connecting the claims to the beach, and a tunnel. BOM investigations found a wide band of gray and cream colored marble in the area. Near the quarry 3.5 by 3.5 by 6-foot marble blocks are scattered. Representative marble samples were collected from the adit. They were found to contain 92.2 percent total $CaCO_3$.

South Arm Cholmondeley Area

Friendship (27)
The Friendship Prospect is along the west shore of South Arm Cholmondeley Sound, 2 miles from the mouth, at elevation 100 feet. There is a flooded pit and a swallow and a 15-foot shaft which exposes a mineralized quarts-calcite vein cropping out along a 350-foot shear zone. The vein filling within the shear zone cuts marble and schist and ore minerals including chalcopyrite, malachite, and azurite are found. Gold and copper were recovered from this vein during BOM sampling.

Moonshine (28)
The Moonshine Mine is on the west side of South Arm Cholmondeley Sound on the crest of a ridge between elevations 2,300 and 2,500 feet, about 1.5 miles from tidewater. Development commenced in 1906 and reported workings at the property include two adits, a 90-foot shaft and glory hole, numerous trenches and pits, and a dilapidated mining camp. The mine operated between 1900 and 1910, with unknown production. The Moonshine Mine developed high-grade silver-bearing galena ore from a well defined quartz-calcite fissure vein occurring in marble and quartz chlorite schist host rock. Lead, silver, copper, and zinc were recovered from this vein during BOM sampling.

Hope-Cholmondeley (29)
The Hope-Cholmondeley Prospect is on the west side of South Arm Cholmondeley Sound between elevations 2,350 and 2,450 feet, about 0.33 miles of the Moonshine Mine. Workings consist of four trenches, a shallow shaft, and a short adit which line up along a -northwest trend. The prospect exposes mineralized quartz-calcite fissure veins and pods in silty marble and chlorite schist host rock. The primary ore minerals are sphalerite and galena with minor chalcopyrite and pyrite. Silver, lead, and zinc were recovered from these veins during BOM sampling.

Ruby Tuesday (30)
Originally named the Ketchikan Copper Co. Prospect, the Ruby Tuesday properties were discovered in 1900. Several drill holes combined with detailed geologic mapping and geochemical sampling data comprise an extensive database available on the property. The three areas of mineralization observed at Ruby Tuesday include: (1) zinc-lead-copper-silver volcano genic massive sulfide adjacent to a marble band, (2) marble hosted disseminated sphalerite, and(3) the replacement lead-zinc pods.

Figure GEO-1
Locations of Mines, Prospects, and Occurrences Within the Chasina Project Area

Source: Mass et al. 1991

Numbers correspond to the individual locations discussed in the text.

Mining Claims

Currently the Bureau of Land Management (BLM) mining claim activity reports indicate that there is one mining claim group consisting of 110 claims within the project area. This is the Ruby Tuesday Prospect which is currently under claim by Abacus Minerals Corporation from Vancouver, British Columbia, Canada. These are centered around the Ruby Tuesday and Friendship Prospects (Numbers 27 and 30 in Figure GEO-1) between South Arm and Cannery Creek. Until recently, Sealaska Corporation had the Kael claim group consisting of 40 claims to the west of Lancaster Cove. These claims have been relinquished. Sealaska Corporation is in the process of receiving subsurface mineral rights on 1,260 acres of the National Forest System lands within the project area as part of the Sealaska Subsurface Exchange Agreement. The subsurface rights which would be conveyed lie south of the southern tip of Kitkun Bay. Sealaska may receive title to an additional 2,685 subsurface acres in the future.

An examination of the Bureau of Land Management records revealed 11 patented mining claim groups within the Chasina Project Area. These are the Golden Fleece (MS 540, 1581),

Valparaiso (MS 766), James (MS 766), Paul Lake (MS 760), Moonshine (MS 789), Jumbo (MS 1058), Amazon (MS 790), Boston (MS 1056), Cape Horn (MS 1055), Stockton Quartz (MS 587), and North Arm Marble (MS 728) (Mass et al. 1995).

Karst Resources

Karst is a comprehensive term that applies to the unique topography, surface and subsurface drainage systems, and landforms that develop in areas of soluble rock. Karst lands are produced by the action of water on soluble rocks, in this case limestones and marbles. The dissolution of the rock results in the development of internal drainage, which produces sinking streams, closed depressions, and other solutional landforms such as sinkholes, collapse channels, caves, etc. (White et al. 1995).

The geologic and climatic setting of Alaska are particularly favorable for karst development. Extensive areas of very pure carbonate, some 515,000 thousand acres (approximately 805 sq. miles or 207,690 hectares), are found within the boundaries of the Tongass National Forest. Because of the highly fractured nature of the carbonates, the climatic conditions, and the peatlands proximal to the carbonate bedrock, karst has developed, to one extent or another, within all carbonate blocks. It has been suggested that karst development to the extent found throughout Alaska is globally rare (Aley et al. 1993).

The Tongass National Forest contains the largest concentration of dissolution caves known in the State of Alaska. The Forest also contains world-class surface or epikarst features particularly in the alpine and sub-alpine zones (Aley et al.1993). The karst and cave features and associated resources are a recently discovered and recognized attribute of the lands within Alaska and have been found to be of national and international significance for a wide variety of reasons, including their intensity and diversity of development, the biological, mineralogical, cultural, and paleontological components, and recreational values (Aley et al. 1993).

The karst landscape in Alaska can be characterized as an ecological unit found atop carbonate bedrock in which karst has developed and includes the recharge areas on adjacent non-carbonate substrate. A few of the characteristics of this ecological unit include: mature, well-developed spruce and hemlock forests, increased productivity for plant and animal communities, extremely productive aquatic communities, well-developed subsurface drainage, and the underlying unique cave resources. Because of the presence of these well developed spruce and hemlock forests, much of the past and proposed timber harvest has been or is focused on the karst lands.

The following are a few key concepts or philosophies of karst management that must be understood to apply any karst management strategy to the land:

1. The Federal Cave Resources Protection Act (FCRPA) is the primary U.S. law affecting caves. It requires protection of significant caves on Federal lands. A cave must possess one or more of the criteria outlined in 36 CFR Part 290.3 to be determined "significant". Though "non-significant" caves may exist, most meet the criteria for "significant". The intent of this act is to protect cave resources not karst resources. However, it is important to recognize that caves and associated features and resources are an integral part of the karst landscape. Karst must be managed as an ecological unit to ensure protection of the cave resources (Baichtal 1994, 1995).

2. As a practical matter, all lands underlain by carbonate rocks within Alaska should be considered a karst landscape. This approach is appropriate because the climatic circumstances of Alaska combined with the purity of the carbonates, proximal peatlands, and highly fractured bedrock are particularly favorable for karst development.

3. Karst lands add a third dimension to land use planning—a vertical dimension. Karst landscapes function differently than other landscapes. One must recognize these differences and change their management strategies accordingly.

4. Subsurface drainage networks generally operate independently of, and with more complexity than, the surface drainage systems above them (Aley et. al. 1993; Huntoon 1992a). The watershed characteristics of the surface topography may have little or no relationship to the subsurface karst drainage system. The many solution-widened fissures become injection points into the complex subsurface drainage system. These fissures rapidly move water and sediment vertically downward into the underground lateral systems. Sediment transported from roads and disturbed lands may emerge unexpectedly at one or more distant springs even across surface watershed boundaries.

5. A large portion of a particular karst system's vulnerability is that system's openness. The degree to which the surface is connected to the karst system conduits at depth relates directly to the affect of any planned land use. A high density of solution and collapse features indicates the presence of well-developed underground systems. The presence of a single sinkhole demonstrates a direct surface/subsurface connection, even if the sinkhole intermittently retains water (Baichtal et al. 1996).

6. It is important to understand the differences in sediment transport mechanisms between karst and non-karst landforms. A particle of soil within deposits atop non-carbonate substrate must be transported by gravity, landslides, and/or surface water flows, sometimes over great distances, into a watercourse to become sediment. Atop a karst landform, depending on the openness of the karst system, a soil particle only needs to be transported laterally a few inches or feet before it can be washed vertically through the epikarst into the karst conduits at depth (Baichtal et al. 1996).

7. On a low-to-moderate vulnerability or sensitivity karst lands where mineral or glacially derived soils fully or partially cover the epikarst, forest regeneration is exceptional. In these areas, even the complete erosion of soil and litter from the surface of the carbonate substrate will not prohibit the reestablishment of a forest, for the displaced surface materials are retained within the epikarst channels (Harding and Ford 1993). However, the overall productivity of the land may have been decreased due to the increase in the percentage of bare rock. It is the inclusions within these areas such as sharp karst knobs, steep slopes, and areas of intense karst development which have had problems regenerating or now support stunted, chlorotic vegetation. On highly sensitive karst lands, the epikarst channels are too deep to allow conifer seedlings to establish themselves even if the displaced soils are retained. It is also possible that the channels are open on their bottom, directly transporting sediment and debris into the karst groundwater system. Highly sensitive or vulnerable karst areas are generally on sites at higher elevations, have thin organic soils which are easily displaced, are on steeper slopes, and/or are in areas of intense karst development. Previous harvest in such areas has resulted in an increase in the percentage of bare rock and less than desirable forest regeneration.

Karst Management Goals

The goal of the karst management strategy proposed here is to maintain and protect, to the extent practical, the natural karst processes and the productivity of the karst landscape while providing for other land uses where appropriate. The proposed strategy is designed to assess a karst resource's vulnerability or sensitivity to a proposed land use. The strategy recognizes the differences in intensity of karst development across the karst landscape.
The key elements of the strategy focus on the openness of karst and its ability to transport water, nutrients, soil and debris, and pollutants into the underlying hydrologic systems. The strategy strives to maintain the capability of the karst landscape to regenerate a forest after harvest, to maintain the quality of the waters issuing from the karst hydrologic systems, and protect the many resource values within the underlying cave systems as per the requirements of the Federal Cave Resource Protection Act (Baichtal et al. 1996).

Karst Management Strategy

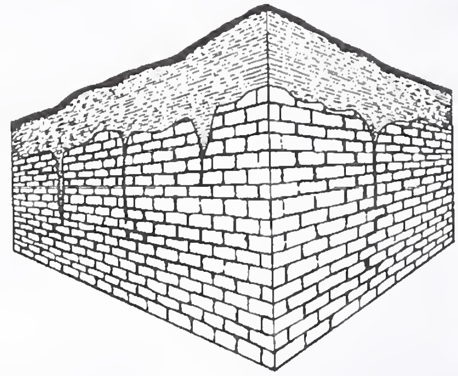
Karst lands impose land management liabilities not encountered in non-karst areas because the three-dimensional landform of karst lands functions differently than other landforms. Recognizing these differences, the Tongass National Forest has begun to change its land management strategies accordingly. The Forest is incorporating karst management standards and guidelines into the current revision of the Tongass Land Management Plan (Baichtal et al. 1996). This same karst management strategy has been applied within the Lab Bay Final EIS on Northern Prince of Wales Island (USFS 1994, 1995a, 1996a), to the Indian River Project Area on Chichagof Island on the Chatham Area of the Tongass National Forest (USFS 1996b), and to Tuxekan Island, west of northern Prince of Wales Island (USFS 1995b). These standards and guidelines provide for other land uses while taking into account the function and biological significance of the karst and cave resources within the landscape. The Forest Service is adopting a land management strategy for the karst lands similar to "hazard area mapping" or "risk assessment". Referred to as "vulnerability mapping" or "karst vulnerability", this strategy assesses the susceptibility of the karst resources to any proposed land use. The thesis of this approach recognizes that not all karst development and associated resources are equal. Vulnerability mapping utilizes the fact that some parts of a karst landscape are more sensitive than others to planned land uses. The zonation scheme is intended as a guide for management purposes at the strategic planning level.

This karst management strategy has been developed during the last five years combining the most current thinking on karst management issues (Aley and Aley 1993; Aley et al. 1993; Blackwell 1995; Eberhard 1994; Griffiths 1991; Harding and Ford 1993; Herring 1995; Huntoon 1992a and b; Kiernan 1993; Lichon 1993; Stringer et al. 1991; Tasmania Forestry Comm. 1993) and the results of field studies specific to the Alaska Karst Lands (Aley et al. 1993; Baichtal 1993a, b, c, 1994, 1995; Baichtal et al. 1996, Elliott 1994; Lewis 1995; Streveler 1991; Swanston 1993; USFS 1994, 1995 a, b, 1996 a, b).

An area's vulnerability rating must be sensitive to potential surface management practices based on the extent to which epikarst has developed, the openness of the karst system, and consideration of the parameters discussed under the karst management goals. The vulnerability categories and their criteria are as follows:

Low Vulnerability Karst Lands

Classification Criteria



Low vulnerability karst lands are those areas where resource damage threats associated with land management activities in the areas are not likely to be appreciably greater than those posed by similar activities on non-carbonate substrate. Some characteristics of these lands are:

- Karst development is limited or has been modified by glaciation;
- Epikarst development is relatively shallow;
- Solutional karst features are present but not numerous;
- Soils are primarily mineral, soil depth is shallow to deep, the soils are moderately well to well drained, parent material is the carbonate substrate, glacial till, or volcanic;
- No caves are present;
- There are no slopes $\geq$ 70 percent;
- The karst hydrologic system does not contribute waters to Class I or Class II streams and/or domestic watersheds;
- They lie within a watershed which contributes surface waters to a karst area determined to have a low vulnerability.

Management Objectives and Appropriate Land Uses

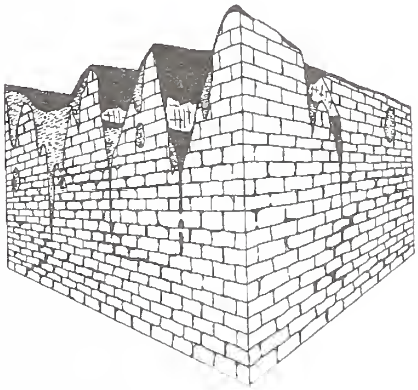
These are areas of low or negligible vulnerability from a karst management perspective. No special provision for the protection of karst values is considered necessary. Timber harvest and related activities could be conducted in such areas in a similar manner to those normally employed on lands underlain by non-carbonate bedrock. Partial suspension yarding may be required. No quarry shall be developed atop karst without adequate site survey and design. Quarries should be properly closed after abandonment. Recreational development would be appropriate with consideration of karst resource values.

It is possible that within and adjacent to areas found to be of low vulnerability will be found karst areas with high vulnerability. Along such boundaries or margins guidelines outlined under "Moderate Vulnerability Karst Lands" shall apply.

Moderate Vulnerability Karst Lands

Classification Criteria

Moderate vulnerability karst lands are those areas where resource damage threats associated with land management activities in the areas are appreciably greater than those posed by similar activities on low vulnerability karst lands. Some characteristics of these lands are:



- Karst systems are moderately well developed;
- Epikarst is up to eight feet in depth;
- Solutional karst features are present but not numerous;
- Soils are a mosaic of both mineral and organic. Mineral soils vary from shallow to deep, are well drained, and parent material is the carbonate substrate. Organic soils are shallow and well drained. If the soil was displaced from the bedrock, it would be retained in the adjacent solutional channels of the epikarst. The percentage of bare rock would increase but the soils would not be transported beyond the rooting depth of young conifers;
- No caves are present;
- There are no slopes $\geq$ 70 percent;
- The karst hydrologic system does not contribute waters to Class I or Class II streams and/or domestic watersheds;
- They lie within a watershed which contributes surface waters to a karst area determined to have a low vulnerability.

Karst Management Objectives and Appropriate Land Uses

Karst management objectives should be taken into account when providing for appropriate land uses. Timber harvest and related activities could be conducted in such areas under more restrictive guidelines than normally employed on lands underlain by non-carbonate bedrock. To protect the fragile soils found here, as a minimum, the yarding system selected may be required to achieve partial suspension. Longer timber harvest rotational periods may be appropriate. Reduced timber harvest unit size and a greater dispersal of harvest units may be required. Existing roads and quarries will be utilized in preference to the construction of new ones. Roads shall avoid sinkholes and other collapse features and losing streams. At no time shall roads divert water to or from karst features. Measures shall be taken to reduce erosion and sediment transport from the road surface and cutslopes. Sediment traps, cut and fill slope revegetation, and road closure and revegetation may be appropriate. Because karst development is more intense here, additional design criteria may be required. Such criteria may relate to road construction methods, blasting, culvert placement and density, and sediment retention and erosion prevention. No quarry shall be developed atop karst without adequate site survey and design. Quarries should be properly closed after abandonment. Recreational development would be appropriate with consideration of the karst resource values listed above, particularly with respect to reducing disturbance of sensitive soils and use of construction methods that avoid erosion and diversion of natural and road drainage waters into karst features.

It is probable that within and adjacent to areas found to be of moderate vulnerability will be karst areas with high vulnerability. Along such boundaries or margins the following guidelines shall apply:

- No surface disturbing activity, such as timber harvest, road construction, and/or quarry development, shall occur within a minimum of 100 feet of the edge of a sinkhole, collapse channel, doline field, losing stream, or other collapse karst feature if groundwater dye tracing studies have indicated that such features contribute to Class I or Class II streams or a domestic water supply. If groundwater dye tracing studies have not been completed and it is suspected that the groundwaters contribute to a "significant" cave, Class I or Class II stream, or domestic water supply, no ground disturbing activity shall occur within 100 feet of any above mentioned karst features;

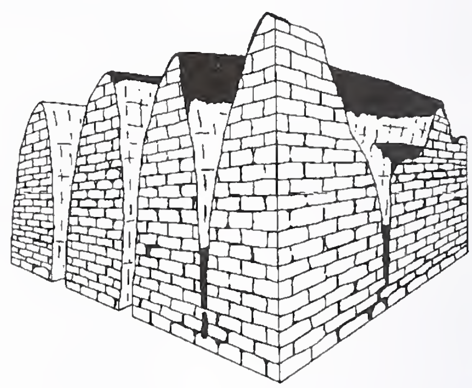
- No surface disturbing activity such as timber harvest, road construction, and/or quarry development will occur on lands that overlie a known "significant" cave or that contribute waters to any known "significant" cave. Neither should these activities occur on lands that are close enough to the entrance of a significant cave to be capable of altering the microclimate of the cave's entrance and/or cave features within;

- When designing buffers to protect karst systems and their features, the buffer should be designed to be wind-firm. There is no credible standard buffer distance that will provide the assurance required to protect the systems from blowdown of the forest within a given buffer. Each buffer must be carefully designed considering wind direction patterns, blowdown history, previous adjacent harvest, topography, and stand windfirmness. Delineated lands surrounding such features and systems must be of sufficient size to insure protection even if blowdown occurs.

High Vulnerability Karst Lands

Classification Criteria

High vulnerability karst lands are those areas where resource damage threats associated with land management activities in the areas are appreciably greater than those posed by similar activities on low or moderate vulnerability karst lands. These are the areas contributing to or overlying significant caves and areas containing a high density of karst features. Some characteristics of these lands are:



- Karst systems are extremely well developed;
- Epikarst is greater than eight feet in depth and may be open to the lateral karst conduits at depth;
- Solutional karst features are numerous;
- Soils are primarily shallow, well drained organics. Exposed bedrock areas are common to extensive. If the soil is displaced from the bedrock, it may be retained in the adjacent solutional channels of the epikarst; however the percentage of bare rock would greatly

increase and the soils most likely would be transported beyond the rooting depth of young conifers. If the karst systems are extremely well developed and open, soils may not be retained within the epikarst channels. They would be rapidly transported to the lateral karst conduits at depth;

- Caves may be present;
- Karst areas may contain slopes ≥ 70 percent;
- The karst hydrologic system may contribute waters to Class I or Class II streams and/or domestic watersheds;
- They lie within a watershed which contributes surface waters to a karst area determined to have a high vulnerability.

Karst Management Objectives and Appropriate Land Uses

These areas shall be managed to insure conservation of karst values through the implementation of a high level of protection. Timber management and related activities should be excluded from these lands. Small expanses of these areas may be crossed by roads to access areas where harvest is appropriate; i.e., low or moderate vulnerability karst lands and non-carbonate areas. This would only be allowed if no other route or option was available and karst resource values would not be compromised. No quarry development would be allowed on these lands. Limited recreational development may be appropriate. Roads across such sensitive terrain, except as described above, are inappropriate. Recreational facilities and trails would have to consider karst resource values and objectives discussed above, particularly with respect to reducing disturbance of significant epikarst features and sensitive soils and use of construction methods that avoid erosion and diversion of natural drainage waters into karst features.

Karst lands found to be of unquestionably high vulnerability shall be identified and removed from the commercial forest lands suitable land base.

Catchment Area Management

The catchment areas for karst systems are those watersheds which contribute to the karst hydrologic systems. The catchment areas, whether comprised of carbonate or non-carbonate substrate, are an integral portion of those systems. These catchment areas must be effectively managed to protect the resource values of the karst systems into which they flow. The higher the resource values found within a particular karst block, the higher the degree of protection which is needed within a contributing catchment area. As a minimum, such things as potential for increased runoff and increased stream velocities, increased sediment transport capability, mass wasting potential of the soils within the watershed, and increased wind-throw potential should be considered when developing management strategies for these catchment areas. During large scale planning efforts, the vulnerability of the karst system's catchment areas should be equal to the highest down-gradient karst vulnerability values. During the site-specific project planning, management strategies developed for the catchment areas should insure protection of the down-gradient karst resource values.

Chasina Project Area Karst Resources

Karst resources are well developed within the Wales Group Marbles of the project area. Drainages disappear along the margins of the faulted marble blocks and sinkholes and other collapse features are numerous across the surface of the karst plateaus. Figure GE0-2 shows the location of the carbonates within the project area boundaries. There are 7,263 acres of the project area on karst, 3,127 acres of those karst lands are on Forest Service lands.

Figure GEO-2
Location of Karst Lands in the Chasina Project Area

Table GEO-1
Acres of Karst Land by Vulnerability Class

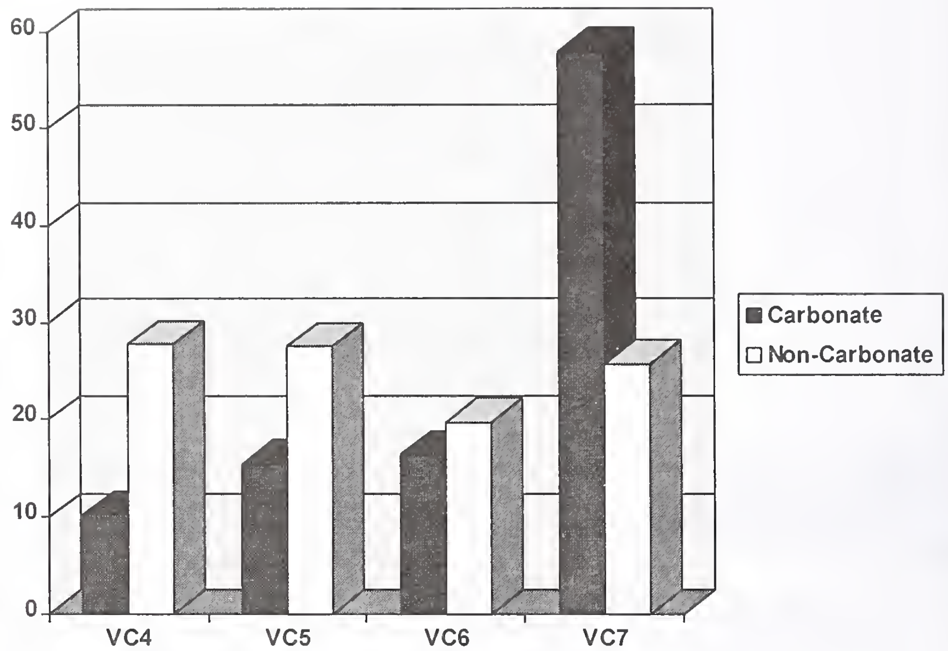
	National Forest Acres	Total
Low Vulnerability Karst Lands	107	687 acres
Moderate Vulnerability Karst Lands	2,637	5,878 acres
High Vulnerability Karst Lands	383	698 acres
Total	**3,127**	**7,263 acres**

Source: USDA-Forest Service, GIS query, TNF

The karst lands of the project area tend to be of moderate vulnerability with inclusions of high vulnerability. The highly vulnerable areas are both discrete karst features and areas of intense epikarst development. Soils are a mosaic of both mineral and organic. Mineral soils vary from shallow to deep, are well drained, and parent material is the carbonate substrate. Organic soils are shallow and well drained. Though karst topography and subsurface drainage systems are well developed in the carbonate substrate, few caves were found. Caves that were discovered tended to be shallow, short tubes within the epikarst zone. The carbonates within the project area tend to be form ridges across the low elevations of the eastern half of the project area. Therefore, few areas contribute surface waters to these higher karst lands.

Some 266 acres of karst lie above 1,500 feet in elevation and are in the alpine or sub-alpine zones. Therefore, 6, 997 acres of forested karst lie within the project area. Past harvest has been disproportionately high within the karst landscape. Though no current GIS layer accurately reflects the amount of timber harvest from the adjacent private lands, it is estimated that 90 percent of those karst lands have been harvested. Based on this estimate and the previous harvest data on USFS lands, 59 percent of the forested karst lands within the project area have been harvested compared to 27 percent of other landscapes. This is most likely due to the size and volume of timber found on top of the karst lands. Figure GEO-3 shows the volume class by percent rock type for the project area.

Figure GEO-3
Timber Volume Class by Percent Rock Type



Source: USDA Forest Service, GIS query, TNF

Effects of the Alternatives

This section describes the potential and direct effect on minerals and karst resources from implementation of the action alternatives.

Minerals

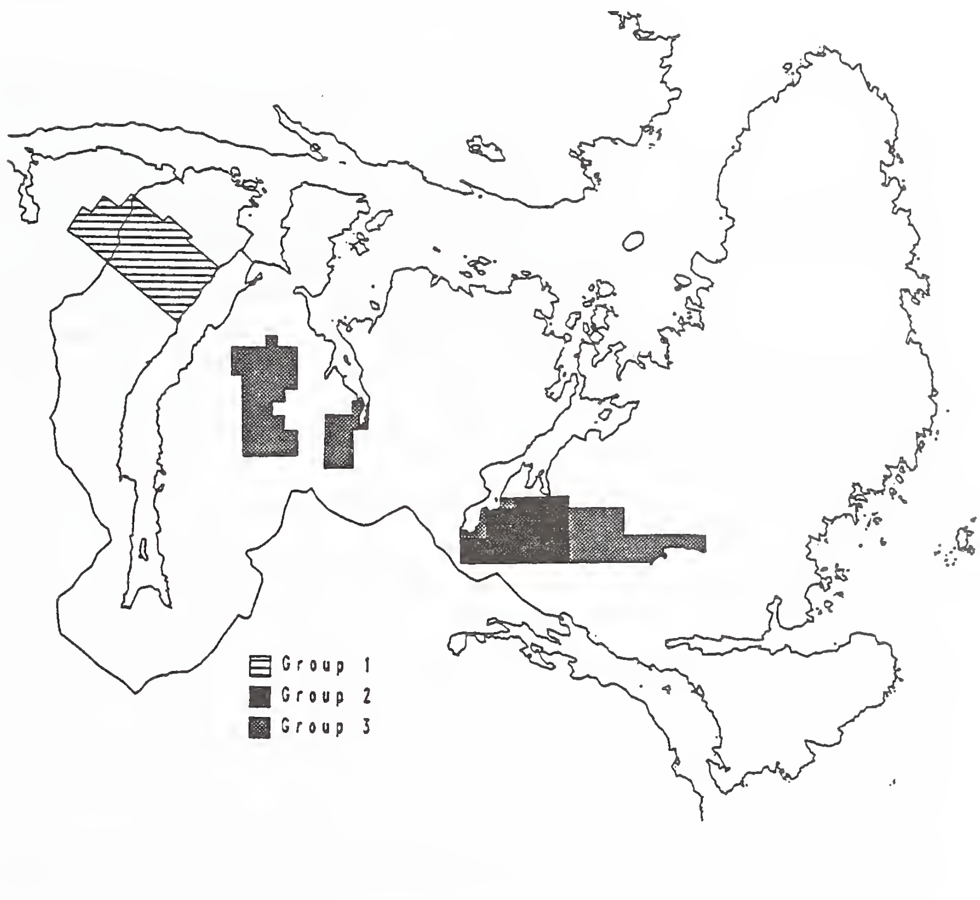
The proposed action would have no direct impact on actual mineral resources. In general, the project would affect mining activities by providing easier access for mapping and surveying because of road construction and access to less developed or underdeveloped areas. Geologic mapping would also be enhanced by increased exposure due to road construction and quarry development. The Ruby Tuesday Claim Group, stretching northwesterly from the South Arm (see Figure GEO-1), would have road access developed under Alternatives 3, 5, and 6. This would greatly improve access to this claim group for further exploration and possible development.

The chemically pure carbonates of Alaska have long been considered for their commodity values. Values are not determined solely on chemical purity but on brightness as well. The more pure the carbonate bedrock, the more intense karst development may be. The impacts of

any proposed mineral development within the karst landscape can be analyzed through the environmental analysis which is triggered once a Plan of Operation is received. However, on karst lands found to be of unquestionably high vulnerability, mineral development would not be appropriate.

Sealaska Corporation has selected 3,945 acres of the project area for the subsurface mineral rights. The selected areas are shown in Figure GEO-4. Sealaska is about to be conveyed the subsurface mineral rights to 1,260 acres in T77S, R88E as part of the Sealaska Subsurface Land Exchange. An additional 1,075 subsurface acres in T77S, R88E and 1,610 acres in T77S, R87E may be conveyed in the future. Once conveyed, quarry development and availability of rock for road construction may be limited in some areas affecting the economics of some alternatives.

Figure GEO-4
Sealaska Corporation Potential Subsurface Mineral Rights in the Chasina Project Area



Karst Resources

Any surface management activity on a karst landscape is likely to affect the components of that landscape. Surface landforms and surface water hydrology would most obviously be affected; however, the direct link between surface water hydrology and subsurface drainage implies that karst hydrologic systems and cave ecosystems would also be affected. The differences in vulnerability or sensitivity of a particular system may be a function of the extent of karst development, the openness of the karst systems, and the sensitivity of other resources that benefit from the karst ground water systems. The components and resources associated with the karst landscape and possible affects of surface management activities on the karst landscape are described at length in Aley et al.1993; Baichtal 1993a and b; Baichtal 1995; Baichtal et al. 1996, Blackwell et al. 1995, Eberhard 1994; Griffiths 1991; Harding and Ford 1993; Huntoon 1992 a and b; Kiernan 1993; Lewis 1995; Lichon 1993; US Forest Service 1994, 1995 a and b, 1996 a, b, and c; and White 1995.

As prescribed in the Karst Management Strategy outlined herein and in US Forest Service 1996 and Baichtal et al. 1996, no harvest would occur on high vulnerability karst lands. From the original unit pool for the Chasina Project Area, two units were dropped and three others modified to protect high vulnerability karst areas. The remaining acres of karst on which timber harvest is proposed can be characterized as moderate vulnerability karst lands which contain discrete karst features of high vulnerability. It can be expected that 10 to 20 percent of the acres of harvest units proposed on karst lands will be deleted to protect discrete karst features.

No dye studies were conducted to determine the subsurface drainage systems present in the karst lands within the project area. Most systems seem to be rather simple with streams sinking into karst features along the upper boundary of a carbonate block and resurging along the lower boundary of the carbonate outcrop, traveling only short distances. The karst plateau north of the Halibut Creek Fault seems, for the most part, to drain to the northeast into a series of small lakes and into Halibut Creek. A few resurgences were mapped along the coastal margins of this carbonate band and along the southern limits. Because no dye studies were undertaken, and most streams which border the carbonate blocks are Class I or II, no ground-disturbing activity shall occur within 100 feet of any karst feature accepting a surface stream(s) or any resurgence.

Table GEO-2 illustrates by alternative the acres of karst proposed for harvest and miles of roads atop karst needed to access harvest units. The table also lists the percentage of the karst harvested on the National Forest and total karst lands which will be effected.

Table GEO-2
Effects of the Alternatives on Karst Lands

		Alternatives					
Item	Units	1	2	3	4	5	6
Area of Karst Harvest Units	Acres	0	101	158	400	198	413
% Karst Harvested on National Forest	% Area	16	20	22	30	23	30
Total % Karst Harvested	% Area	50	60	61	65	62	65
Roads on Karst	Miles	7.51	8.73	10.08	11.76	10.56	13.01

Source: USDA-Forest Service, GIS query, TNF

Mitigation

Mineral Resources

No mitigation measures are recommended in relation to possible mineral development in the area. All known mineral improvements, such as mine claim markers, would be protected.

Karst Resources

On moderate vulnerability karst lands where timber harvest is proposed, the following karst management objectives and land uses are appropriate. The intent of this mitigation is to provide for other land uses taking into account karst management objectives. Timber harvest and related activities could be conducted in such areas under more restrictive guidelines than normally employed on lands underlain by non-carbonate bedrock. To protect the fragile soils found here, as a minimum, the yarding system selected may be required to achieve partial suspension. Longer timber harvest rotational periods may be appropriate. Reduced timber harvest unit size and a greater dispersal of harvest units may be required. Existing roads and quarries will be utilized in preference to the construction of new ones. Roads shall avoid sinkholes and other collapse features and losing streams. At no time shall roads divert water to or from karst features. Measures shall be taken to reduce erosion and sediment transport from the road surface and cutslopes. Sediment traps, cut and fill slope revegetation, and road closure and revegetation may be appropriate. Because karst development is more intense here, additional design criteria may be required. Such criteria may relate to road construction methods, blasting, culvert placement and density, and sediment retention and erosion prevention. No quarry shall be developed atop karst without adequate site survey and design. Quarries should be properly closed after abandonment. Recreational development would be appropriate with consideration of the karst resource values listed above, particularly with

respect to reducing disturbance of sensitive soils and use of construction methods that avoid erosion and diversion of natural and road drainage waters into karst features.

It is probable that within and adjacent to areas found to be of moderate vulnerability, will be karst areas with high vulnerability. Karst lands found to be of unquestionably high vulnerability shall be identified and removed from the commercial forest lands suitable land base. Along such boundaries or margins the following guidelines shall apply:

1. No surface disturbing activity such as timber harvest, road construction, and/or quarry development shall occur within a minimum of 100 feet of the edge of a sinkhole, collapse channel, doline field, losing stream, or other collapse karst feature if groundwater dye tracing studies have indicated that such features contribute to Class I or Class II streams or a domestic water supply. If groundwater dye tracing studies have not been completed, and it is suspected that the groundwaters contribute to a "significant" cave, Class I or II stream, or domestic water supply, no ground disturbing activity shall occur within 100 feet of **any** above mentioned karst features;

2. No surface disturbing activity such as timber harvest, road construction, and/or quarry development will occur on lands that overlie a known "significant" cave or contribute waters to any known "significant" cave. Neither should these activities occur on lands that are close enough to the entrance of a significant cave to be capable of altering the microclimate of the cave's entrance and/or cave features within;

3. When designing buffers to protect karst systems and their features, the buffer should be designed to be windfirm. There is no credible standard buffer distance that will provide the assurance required to protect the systems from blowdown of the forest within a given buffer. Each buffer must be carefully designed considering wind direction patterns, blowdown history, previous adjacent harvest, topography, and stand windfirmness. Delineated lands surrounding such features and systems must be of sufficient size to insure protection even if blowdown occurs.

Monitoring

A monitoring strategy should be developed and maintained which determines the effects of land uses, specifically timber harvest and road construction on the karst landscape. As a minimum, karst hydrology, soil loss, forest regeneration, sedimentation, and debris transport should be monitored.

Wildlife

Key Terms

Carrying capacity—the maximum number of a wildlife species that a certain area will support through the most critical period of the year.
Habitat—the sum total of environmental conditions of a specific place that is occupied by an organism, population, or community of plants or animals.
Habitat capability—an estimated number of animals that a habitat could potentially sustain.
Management Indicator Species (MIS)—species of vertebrates and invertebrates whose population changes are believed to best indicate the effects of land management activities.
Viable population—the number of individuals of a species required to ensure the long-term existence of the species in natural, self-sustaining populations adequately distributed throughout their region.
Wildlife Analysis Area (WAA)—divisions of land used by the Forest Service that correspond to Minor Harvest Areas used by the Alaska Department of Fish and Game.

Affected Environment

Alaska's wildlife are valuable for aesthetic, economic, recreational, ecological, and subsistence reasons. Over 350 species of mammals, birds, amphibians, and reptiles occur on the Tongass National Forest, and most of these, except brown bear and mountain goat, can be found in the Chasina Project Area. They occupy a diverse range of land types and plant communities and are variably adapted to climatic extremes, change in habitat, predation, and hunting pressure.

Management Indicator Species (MIS)

Management Indicator Species (MIS) are species of vertebrates and invertebrates whose population changes are believed to best indicate the effects of land management activities (USDA Forest Service 1982). Through the MIS concept, the total number of species occurring within a project area is reduced to a manageable set of species that collectively represent the complex of habitats, species, and associated management concerns. The MIS are also used to help set management goals for species in public demand (TLMP RSDEIS 1996a).

The following have been selected as MIS for this project and will be discussed in detail in this chapter:

Species	Rational for Selection
Sitka black-tailed deer	Important game species
Marten	Old growth; important furbearer
Black bear	Represents estuarine habitat; game species
Bald eagle	Old-growth coastline; high public interest
River otter	Represents riparian habitat; furbearer
Hairy woodpecker	Cavity excavator
Brown creeper	Represents large, high volume, old-growth trees
Vancouver Canada goose	Represents riparian habitat; game species
Gray wolf	Species of concern

The following species were selected as Tongass National Forest MIS, but have not been selected as MIS for the Chasina Project Area:

Species	Rationale for Nonselection
Brown bear	Does not occur in project area
Red-breasted sapsucker	Abundant and adaptable in project area
Mountain goat	Does not occur in project area
Red squirrel	Does not occur in project area

Wildlife Analysis Areas (WAAs)

Wildlife Analysis Areas (WAAs) represent divisions of land that the Alaska Department of Fish and Game (ADF&G) uses for data collection purposes and the Forest Service uses for wildlife analysis purposes. WAAs included in the Chasina Project Area are 1210, 1211, and 1213 (Figure WIL-1). Specific VCUs that are included within project area WAAs are listed in Table WIL-1. See the Subsistence section of this chapter for a further analysis of wildlife species by WAA.

Table WIL-1
VCUs Within Wildlife Analysis Areas (WAAs) and Percent of the WAA that Includes the Project Area

WAA	% of WAA in Project Area	VCUs
1210	5	682
1211	100	677, 678, 679, 680, 681
1213	6	674

SOURCE: USDA-Forest Service, GIS Data Base.

Figure WIL-1
Wildlife Analysis Areas

Wildlife Analysis Areas (WAAs) are divisions of land identified by ADF&G and used by the USDA Forest Service for wildlife analysis.

Major Habitat Categories

The following categories are the types of environments in which species occur. The environment can be described in physical or biological terms, which often includes elevation, topography, and type of vegetative community. A species may occupy a range of different habitats or more than one distinct kind of habitat in different seasons. Terrestrial habitats in the Chasina Project Area include:

- Beach fringe
- Estuary fringe
- Riparian
- Forest
  - Old-growth forest
  - Second-growth forest
- Alpine/subalpine
- Muskeg (Peatlands)

A brief description of these habitats follows. Table WIL-2 displays an acreage inventory of each habitat by WAA. Note that because several categories overlap each other (e.g., beach fringe may contain some old-growth and some riparian habitats), the sum of the total acres will not be the same as the total acreage announced for the project area.

Table WIL-2
Major Habitat Categories in the Project Area, 1996 (by Wildlife Analysis Area), in Acres*

WAA	500 ft. Beach Fringe	1,000 ft. Estuary Fringe	Old-Growth Forest	Second-Growth Forest	Commercial Forest (Vol. Class 4-7)	Alpine Subalpine	Riparian Management Area	Muskeg
1210	764	586	4,256	32	2,453	2	566	272
1211	6,537	8,022	31,306	1,931	20,322	1,117	10,854	1,090
1213	58	87	1,869	0	1,403	390	874	0
Total	**7,359**	**8,695**	**37,431**	**1,963**	**24,178**	**1,509**	**12,294**	**1,362**

*Certain use areas overlap. For example, old-growth and second-growth forest are also included in beach fringe and estuary fringe habitats.

Beach Fringe

For the purposes of this analysis, beach fringe is the land within 500 feet of the mean high tide and excludes estuarine habitats. Areas within 500 feet of the ocean shoreline are transitional zones between land and water, salt and freshwater, and vegetated and non-vegetated conditions (USDA Forest Service 1979a). Forested areas in this transitional zone are heavily used by species with high economic, recreational, subsistence, or aesthetic values. Black bear, river otter, bald eagle, marten, Sitka black-tailed deer, and Vancouver Canada goose concentrate their activities during some seasons in these forest stands. No alternatives in the Chasina EIS propose any additional timber harvest within beach fringe.

Estuary Fringe

Estuary fringe habitat is a 1,000-foot zone around estuaries. Bears, waterfowl, furbearers, and eagles are the primary users of the estuary fringe habitat. The estuary fringe is similar to beach fringe, but because of species diversity, it has a greater value to wildlife, especially black bears, river otters, mink, bald eagles, and waterfowl. No harvest is proposed within the estuary fringe in any of the alternatives for the Chasina Project Area.

Riparian

The riparian habitat is recognized as some of the most productive wildlife habitat in Southeast Alaska. It occurs along rivers and streams or around inland lakes, and contains elements of both aquatic and terrestrial ecosystems. Many wildlife species use riparian zones to a much greater extent than other areas (USDA Forest Service 1985), and riparian habitats are extremely important for eagles, furbearers, and black bears (USDA Forest Service 1986). Riparian areas are important migration routes for some wildlife species and serve as travel routes for numerous species because of the presence of water, food, and cover.

Alternatives described in this EIS do not propose any harvest adjacent to Class I or II streams or lakes larger than 5 acres, except for road construction; the width of all proposed buffer strips is at least 100 feet. For additional information see the Soils and Aquatics sections of this chapter.

Forest

Forest habitat includes all areas with forest cover, including old growth and second growth described below, and noncommercial forest land as described in the Silviculture and Timber section of this chapter. Many wildlife species, including those associated with old-growth stands, will to different degrees use all forested areas within the project area.

Old-growth Forest

Old-growth forest is characterized by stands of trees, usually well past the age of maturity with declining growth rates and signs of decadence, such as dead and dying trees, snags, and downed woody material. The stand usually includes large diameter trees, multi-layered canopies, a range of tree diameter sizes, and the notable presence of understory vegetation. These and other characteristics make old-growth forests important habitat for Sitka black-tailed deer, marten, black bear, and cavity nesting birds such as the hairy woodpecker. These forests are in a dynamic, steady state where the death of old trees is balanced by the growth of new trees. This category of old growth includes the unproductive forest as well as the productive commercial forest lands. Old-growth forest acres are also included in beach fringe, estuary fringe, riparian, and other habitat areas. For a more detailed discussion of old-growth vegetation, see the Silviculture, Timber and Other Vegetation and Biodiversity sections of this chapter.

Second-growth Forest

Second-growth forest is defined for the purposes of this section as consisting mostly of areas that have been harvested. Large-scale second-growth stands are of lower value to wildlife such as deer, marten, bear, and cavity nesters. Conifer seedlings aggressively invade and eventually shade out desirable herbaceous vegetation and provide fewer trees and snags suitable for excavation by woodpeckers and other cavity users. This habitat type was inventoried to help display the amount of past timber harvest activity that has occurred within the Chasina Project Area. Some second-growth forest has been created naturally by windthrow, landslides, and avalanches.

Alpine/Subalpine

The alpine/subalpine category includes all stands at or above treeline, including open meadows of grasses, forbs, and shrubs; and scrub forest (Sidle and Suring 1986). Subalpine habitat includes a mosaic of forested, scrub, and non-forested stands that occur at higher elevation than the upland forest, at the lower edge of the alpine zone (Sidle and Suring 1986). Alpine/subalpine habitat within the Chasina Project Area is generally above 2,000 feet in elevation. These habitats are important summer foraging areas for deer and black bear.

Muskeg (Peatlands)

Muskegs are most often characterized by stunted yellowcedar and shore pine, along with sedges and other bog vegetation. Muskegs dominated by sphagnum moss or tall sedge cover smaller areas. The water table is at the surface, and numerous small ponds are scattered throughout the muskeg.

Wildlife Habitat Capability Models

Wildlife models were used to calculate habitat capability for each MIS in the project area. For specific information on the models used, see Appendix B of the TLMP Draft Revision 1991a. Because of the amount of timber harvest on non-National Forest System Lands throughout the Ketchikan Administrative Area, a maximum potential impact was assumed and no habitat capability was calculated for State or private lands. There are 1,744 acres of conveyed State Selection land and 18,223 acres conveyed to Kootznoowoo Native Corporation within the 68,926 acre project area (see Land Adjustments, Uses, and Permits section of this chapter). The terms "habitat capability" and "populations" are not interchangeable. Habitat capability is the estimated number of animals the habitat can support through the most critical period of the year. Population is the estimated number of animals actually present at a given time. Populations may temporarily exceed habitat capability (for example, due to a series of mild winters). However, populations may be below what the habitat is capable of producing, due to predation, winter mortality, or other ecological factors in some years.

Given data limitations, the complexity of ecological relationships, and the need to simplify variables for use in the models, actual population sizes in some areas may vary considerably from those predicted by the analysis. However, the procedures provide estimates of habitat capability that over time are expected to be a reasonable indicator of population trends as they relate to the amount and quality of habitat only. Actual populations at any given point in time can be greatly influenced by weather, hunting, trapping, disease, predation and related factors. Table WIL-3 estimates the 1954 and the current (1996) wildlife habitat capability in the project area.

Table WIL-3
Wildlife Habitat Capability within the Chasina Project Area

Selected MIS	1954*	1996*	Percent Change
Sitka Black-tailed Deer**	2,410	2,017	-16
Marten**	97	86	-11
Black Bear	86	77	-10
Bald Eagle	123	121	-2
River Otter	52	52	0
Hairy Woodpecker**	900	890	-1
Brown Creeper**	1,983	1,947	-2
Vancouver Canada Goose	242	222	-8
Gray Wolf	7	5.8	-16

SOURCE: Matson 1996. USDA-Forest Service GIS Data Base and interagency habitat capability models.

* Habitat Capability for just the portion of WAAs in the project area.
** Patch-size Effectiveness calculations are displayed in the Biodiversity section.

Sitka Black-tailed Deer

The Sitka black-tailed deer was chosen as an MIS because it is an important game and subsistence species and is seasonally associated with old-growth forests.
Historically, population fluctuations of Sitka black-tailed deer in Southeast Alaska have been linked with winter severity (Merrian 1970) and predation pressure (Van Ballenberge and Hanley 1984). Deep snow and late springs associated with severe winters have occurred several times in the past 80 years. Deer die-offs are common during severe winters, even in the best old-growth winter ranges. Predators of deer, gray wolves, bears, and hunters, can also contribute to the population decline during these winters, inhibiting subsequent recovery of the deer population. In general, winter severity increases with latitude and with a decreased maritime influence in Southeast Alaska (Longhurst and Robinette 1981); within the project area, VCUs 679, 680, and 681 have a low snow depth rating, and VCU 674, 677, 678, and 682 have a moderate snow-depth rating.

Research conducted throughout Southeast Alaska indicates that high volume, old-growth forests at lower elevations are essential to maintaining a sustainable deer population during severe winters (Schoen et al. 1985; Hanley and Rose 1987; Yeo and Peek 1992). Large strong branches, characteristic of the old-growth stands, intercept snow, providing for deer mobility while maintaining the availability of forage. High volume stands of old-growth forests support adequate herb and shrub layers of deer forage. In most cases, timber harvest of deer winter range reduces the long-term quality of deer winter range. Effects on deer populations are compounded by the combination of deep-snow winters and large amounts of deer winter range

converted to second growth. Snow significantly reduces forage availability in clearcuts during the winter. Closed canopy second-growth stands provide little to no forage in winter or summer. The amount of second growth and winter severity are key factors in determining the capability of the land to support deer populations.

An interagency model (Suring et al. 1992) was developed to evaluate the potential quality of winter habitat for Sitka black-tailed deer. Winter is assumed to be the most limiting season for the Sitka black-tailed deer throughout the area (Hanley and McKendrick 1985, cited by Suring et al. 1992). The deer model incorporated the following factors in the analysis: (1) snow conditions, (2) presence of predators, (3) physiographic features including aspect and elevation, (4) patch size, and (5) vegetational characteristics including: (a) volume class of old growth, (b) forest type, (c) second growth (25 to 150 years), and (d) clearcut (0 to 25 years).

Results of the deer model indicates there is a habitat capability for approximately 2,017 deer in the Chasina Project Area (Table WIL-3). This represents a 16 percent reduction in habitat capability since 1954, because of past timber harvest. Table WIL-4 shows habitat capability by WAA at current conditions and before 1954.

Three of the six VCUs that make up the Chasina Area are rated as “low snow” which results in a higher deer habitat capability. National System land within the Chasina Project Area is good deer habitat, primarily because of low elevation, low snow, and large blocks of forest cover. This corresponds with what was observed during field reconnaissance; most of the best deer habitat is in the low elevation areas around Kitkun Bay, Cannery Creek and Chasina Point.

Table WIL-4
ADF&G Population Objectives and Deer Habitat Capability by WAA for 1954 and 1996 in the Chasina Project Area and for the Entire WAA

WAA	ADF&G Population Objectives	1954 Habitat Capability Entire WAA	1954 Habitat Capability Project Area	1996 Habitat Capability Project Area	1996 Habitat Capability Entire WAA	Percent Change Project Area	Percent Change Entire WAA
1210	1,950	2,600	207*	198*	2,600	-4*	0
1211	1,653	2,204	2,141*	1,757*	2,187	-18*	<1
1213	906	1,208	62*	62*	1,197	0*	1
Total	**4,509**	**6,012**	**2,410**	**2,017**	**5,984**	**-16**	**<1**

SOURCE: USDA-Forest Service GIS Data Base and Sitka Black-tailed Deer Habitat Capability Model, Suring et al, 1992.

* Numbers do not incorporate Patch-size Effectiveness calculations.

Deer Population Objectives
The ADF&G has established deer population objectives for all WAAs in Southeast Alaska for the years 1991-1995. The population objectives for the individual WAAs can be found in "Population Objectives—Strategic Plan for Management of Deer in Southeastern Alaska 1991-95" (ADF&G 1991).

Deer population objectives for the WAAs range from maintaining deer habitat at 100 percent of the 1954 level, to 75 percent of the 1954 level. The existing habitat capability for deer in all WAAs is well above ADF&G population objectives. A complete analysis of how projected Forest-wide timber harvest levels affect deer habitat capability compared to the ADF&G population objectives can be found in the TLMP Draft Revision (1991a).

Marten
The marten was selected as an MIS to represent old-growth associated species. The marten is also an important furbearer. Marten populations are moderate in the project area. Trapping pressure is moderate from residents of Neets Bay and the Ketchikan Area. High pelt prices, susceptibility to trapping pressure, and liberal trapping regulations have created a large demand for marten.

Marten prefer mature old-growth forests with a well developed overhead canopy. Snags and downed woody debris are important to martens for winter and summer dens and resting sites and cover for prey species. The distribution and abundance of marten is determined to a large extent by the availability of cover and the presence of prey species (Simon 1980).

Throughout the year, especially in the winter, small mammals are an important food source for martens. During the summer their diet is supplemented by birds, insects, fruits, and berries.

The model was developed to evaluate the potential quality of winter habitat for the marten (Suring et al. 1988a). The underlying assumption is that if adequate winter habitat is available, habitat requirements throughout the rest of the year will not be limited. The model incorporated the following factors in the analysis: (1) classes of timber volume in old-growth forests, (2) stand size classes (stand age), (3) beach fringe habitat, (4) riparian habitat, (5) elevation, and (6) old-growth patch size.

The marten model (without patch-size effectiveness taken into consideration) indicates there is habitat capability for an estimated 86 martens in the Chasina Project Area (Table WIL-3). This 11 percent decline from the 1954 habitat capability of 97 marten is due to past harvest activity.

Black Bear
The black bear was selected as an MIS to represent estuarine habitat. The black bear is also an important game species. Black bears occur throughout the project area, and populations are currently stable. As of the 1990/91 black bear harvest season, nonresident hunters have been limited to one black bear, while Alaska residents may harvest two black bear.

Black bears are highly adaptable and can tolerate moderate disturbances, such as habitat alteration, as long as the basic requirements for food and cover are satisfied (Lawrence 1979). As clearcut stands mature, both forage resources and numbers of denning sites may decline.

After emergence from dens in the spring, black bears seek sources of new plant growth for food (Mondafferi 1982). Grass flats of estuaries, low elevation forests near the beach (beach fringe habitats), and avalanche slopes provide the needed high quality forage. The Kitkun estuary receives heavy spring and summer bear use. During the summer, black bears feed on forbs, berries, and salmon. In the fall they feed on berries and forbs (Sidle and Suring 1986) in the subalpine areas.

Bear den sites include: (1) cavities in trees and stumps; (2) caves; and (3) excavated and natural depressions under tree roots, stumps, and fallen logs. Black bears search for food in clearcuts that provide access to cover, which is found in mature and old-growth forests. Clearcuts 10 to 15 years old are preferred because of the production of large amounts of berries (Lindzey and Menslow 1977).

The model for black bears incorporated the following factors in the analysis: (1) the average annual value of upland habitats, (2) the average annual value of riparian habitats and potential salmon production, and (3) the average annual value of beach fringe habitats. (For more information regarding the model see: Suring et al. 1988b.)

The black bear model indicates there is habitat capability for an estimated 77 black bears in the Chasina Project Area (Table WIL-3). This is a 10 percent decline from the pre-1954 habitat capability of 86 black bears.

Bald Eagle

The bald eagle was selected as an MIS because the public has a strong interest in the species and the species has special habitat requirements. Bald eagle habitat is defined as beach fringe habitat. The majority of eagles in Southeast Alaska nest in coniferous forest habitats along the coastline and associated saltwater inlets (Suring et al. 1988c). Eagles prefer to nest in continuous stands of old growth rather than in narrow leave strips of old-growth trees. Of the 3,850 nests surveyed in Southeast Alaska, 92 percent were within 300 feet of the shoreline (Hodges and Robards 1982).

Bald eagles nest adjacent to the habitat that provide the best opportunities for foraging or searching for food, such as over open water and on tidal flats. Eagles primarily feed on fish, but are also known to feed on water birds, marine invertebrates, and carrion. Perch sites near the nest and foraging areas are also important components of bald eagle habitat. The bald eagle and its habitat have been given special protection through the Bald Eagle Protection Act as implemented by an Interagency Agreement between the Forest Service and the U.S. Fish and Wildlife Service (USDA Forest Service and USDI Fish and Wildlife Service 1990). Among the provisions of the Interagency Agreement are: requirement of a 330-foot vegetation protection buffer around eagle nests, timing restrictions for blasting within one half mile of known nests, and a requirement that formal consultation with the U.S. Fish and Wildlife Service take place when any portion of the agreement cannot be implemented. The U.S. Fish and Wildlife Service and Forest Service personnel have identified 54 nest sites in the Chasina Project Area. Table WIL-5 displays the number of identified eagle nests which occur in each WAA.

Table WIL-5
Number of Eagle Nests by WAA

WAA	# Nests
1210	0
1211	52
1213	2
Total	**54**

SOURCE: USDA-Forest Service GIS Data Base.

The model evaluated only the nesting habitat of bald eagles because limited information is available on the winter habitats and movements of bald eagles in Southeast Alaska (Suring et al. 1988c). The model considered the following factors in the analysis: (1) old-growth forest, (2) volume class, (3) distance from shore, and (4) elevation of riparian habitat.

The model indicates there is nesting habitat capability for an estimated 121 eagles (Table WIL-3). This is a 2 percent decline from the pre-1954 habitat capability of 123 eagles. Some evidence exists that nest sites are not the most limiting factor (TLMP Revision 1991a).

River Otter
The river otter was selected as an MIS to represent riparian habitats. The river otter is also an important furbearer.

River otters concentrate along intertidal zones and the adjacent narrow beach fringe. They also travel extensively throughout streamside habitats. The old-growth forests in Southeast Alaska are assumed to provide optimum habitat for river otters (Suring et al. 1988d), with seedling and sapling (i.e. clearcut) and pole timber stands providing limited habitat. Otters avoid clearcuts extending to the beach in Southeast Alaska (Larsen 1983) because of lack of cover and density of shrub growth. High value otter habitat must provide adequate shelter in addition to sufficient food (Melquist and Hornocker 1983). River otters feed on fish (primarily sculpins and rockfish), crabs, and occasional invertebrates other than crabs (Sidle and Suring 1986).

River otters depend on large woody debris in streamside, lakeside, and beach habitats. The large extensive root systems, downed tree trunks, and overturned root wads of old-growth trees create undercuts and hollows that maintain den and resting sites and cover. From May through July, female otters use old-growth habitats near streams for inland dens (up to 0.5 miles from the coastline). The annual harvest of river otter on the Tongass National Forest has varied from a high in 1979-80 of 652 animals, to a low of 373 animals in the 1986-87 harvest season. Harvest numbers are a function of both otter abundance and trapper effort.

Habitat capability for this species was determined for spring (May through July) because river otters make use of all occupied habitats at this time of year (Suring et al. 1988d). The model

incorporated the following factors in the analysis: (1) distance from saltwater, (2) beach, (3) estuary, (4) elevation of riparian habitat, (5) volume class, (6) stream class, and (7) lake size.

The model indicates there is habitat capability for an estimated 52 otters (Table WIL-3) in the Chasina Project Area, which indicates no decline in habitat capability from 1954.

Hairy Woodpecker

The hairy woodpecker was chosen as an MIS representing cavity users because of its preference for stands of old-growth western hemlock and Sitka spruce, and for its association with snags (standing dead trees). Hairy woodpeckers are year-round residents in Southeast Alaska and use snags and partially dead trees for nesting and foraging. These woodpeckers feed on larvae of wood-boring beetles, other insects, and seeds and berries in the winter (Sidle and Suring 1986).

The hairy woodpecker is important as a primary cavity excavator because by drilling holes in trees it creates habitat needed for other wildlife species (Kesseler 1979; Noble and Harrington 1977). Forty-two species of mammals and birds in Southeast Alaska nest or den in tree cavities, including woodpeckers, owls, hawks, waterfowl, bats, squirrels, martens, and otters. Several of these species depend exclusively on cavities in the large diameter snags characteristic of old-growth stands for nest and den sites. Most cavity nesting or denning species would be represented by hairy woodpeckers and respond similarly to proposed activities.

Hairy woodpecker habitat is defined as Volume Class 4 through 7 timber stands below the subalpine category. Availability of suitable winter habitat for roosting and foraging is considered an important constraint on the habitat suitability of the hairy woodpecker. The model (Suring et al. 1988e) incorporates the following factors in the analysis: (1) old-growth forests, (2) volume class, and (3) old-growth patch size.

The model indicates there is habitat capability in the Chasina Area for an estimated 890 hairy woodpeckers (Table WIL-3). This is a 1 percent decline from the pre-1954 habitat capability of 900 woodpeckers.

Brown Creeper

The brown creeper was chosen as an MIS because it is associated with large, old-age trees and represents the old-growth forest community. Brown creepers and other bark foraging birds also select larger diameter trees as foraging sites during cold, windy weather to lessen their exposure (Grubb 1975, Webber 1986). The diet of brown creepers consists of larvae, pupae, and eggs of insects gleaned from the crevices of bark, spiders, other small invertebrates, and occasionally seeds (Pearson 1923, Reilly 1968). Large diameter trees are preferred because a bird can feed longer on a large tree and capture more prey per visit (Airola and Barrett 1985).

The abundance of large coarse-barked trees and the length of the vertical foraging height appears to affect the territory size (Apfelbaum and Hanley 1977); the area necessary to support the birds increases as the number of large, tall trees decreases. Brown creepers spend most of their time foraging on live parts of trees rather than dead trees (Morrison et al. 1987).

Brown creeper habitat is defined as Volume Class 6 and 7. Slightly more than one-tenth of the number of brown creepers observed in stands with 30,000 board feet per acre were observed in stands with 20-30,000 board feet per acre (i.e., Volume Class 5) (Hughes 1985).

Other habitats in Southeast Alaska were not considered to provide suitable habitat for brown creepers.

The model indicates there is habitat capability in the Chasina Project Area for an estimated 1,947 brown creepers (Table WIL-3). This is a 2 percent decline from the pre-1954 habitat capability of 1,983 brown creepers.

Vancouver Canada Goose

The Vancouver Canada goose was selected as an MIS to represent old-growth and riparian habitats. The Vancouver Canada goose is also a game species.

Banding studies have indicated Vancouver Canada geese are primarily nonmigratory (Ratti and Timm 1979) and are found almost exclusively in Southeast Alaska. These geese use forested habitats for nesting and brood rearing; they place nests in trees, use trees for perches during incubation, and rely primarily on forest understory plant species for food during this part of their life cycle (Doyle et al. 1988). Lebeda and Ratti (1983) suggest that the three most important factors for nesting Vancouver Canada geese are: (1) dense understory vegetation, (2) forest surrounding surface water, and (3) an abundant food source.

For an analysis of the effects on Vancouver Canada geese, the model developed by Doyle et.al. (Habitat Capability Model for Vancouver Canada Goose in Southeast Alaska; Nesting and Brood Rearing Habitat 1988) was used. This model only considered those habitats within 2,600 feet of uncontained river channels, lakes, or salt water as being suitable for Vancouver Canada geese.

The model indicates there is habitat capability in the Chasina Project Area for an estimated 222 Canada geese (Table WIL-3). This is an 8 percent decline from the pre-1954 habitat capability of 242 Canada geese.

Gray Wolf

The gray wolf was selected as an MIS species because of public concerns over what effects additional timber harvest and higher road densities would have on the wolf population within the Chasina Project Area.

Gray wolves do not exhibit a preference for specific habitats or habitat characteristics (Paradiso and Nowak 1982). The presence and well being of gray wolves appears to be dependant on the availability of prey rather than on landform, climate, or vegetation.

A review of the population dynamics of gray wolves demonstrated that rates of increases are primarily determined by the availability of deer and other ungulate prey (Keith 1983). Packard and Mech (1980) concluded that intrinsic social factors and the influence of food supply are interrelated in determining population levels of gray wolves. It has been demonstrated that predation by gray wolves sustains declines in ungulate populations that have been initiated by other factors (e.g., severe weather, habitat changes) (Mech and Karns 1977, Nelson and Mech 1981, Gasaway et al. 1983, Van Ballenberghe and Hanley 1984, Smith et al. 1986).

Prey species available to gray wolves in Southeast Alaska include Sitka black-tailed deer, moose, mountain goat, beaver, and spawning salmon. Of these species, deer, beaver, and spawning salmon are the primary prey in the Chasina Project Area.

The habitat capability model developed for wolf primarily runs off the habitat capability model outputs of the deer, moose, and mountain goat models. For the project area, only the deer habitat capability model outputs were used. The gray wolf habitat capability model estimates the Chasina Project Area can support approximately six wolves (Table WIL-3). This is a 16 percent reduction from the pre-1954 habitat capability of approximately 7 wolves.

Effects of the Alternatives

This analysis considers the direct, indirect, and cumulative effects of timber management in the project area. Direct effects are projected to 1998, the anticipated end of the current proposed action; to 2004, which includes the reasonably foreseeable future and the end of the KPC Long-term Sale Contract; to 2040, to show the cumulative impacts of past and proposed timber harvest; and to 2140, to show the cumulative impacts of harvesting all the suitable lands through the first rotation and halfway through the second.

Direct and Indirect Effects

Comparison of Alternatives: Effects on Wildlife Habitat
Each action alternative includes harvest of wildlife habitat. Project unit design criteria, BMPs (FSH 2509.22, 1991), and/or legislated protective measures (TTRA) and Forest Standards and Guidelines significantly reduce or eliminate potential impacts to beach fringe, estuary fringe, and riparian habitats in each alternative. Alpine/subalpine habitat is not affected by road and unit location because of inaccessibility and/or low productivity. Changes throughout the project area in these habitats are 1 percent or less for each alternative (Table WIL-6). Impacts to MIS that depend on these habitats are low. Alternative 1, the no-action alternative, will harvest no acreage, with the effect that existing wildlife habitats will remain at current levels, with changes over time due only to natural succession or future timber harvest.

Table WIL-6 displays the percent change in wildlife habitats as a result of timber harvest.

Table WIL-6
Proposed Acres for Harvest and Percent Change from 1954 in Wildlife Habitats by Alternative

			Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt. 6	
	1954 Acres	Existing Acres	Acres Cut	% Chg	Acres Cut	% Chg	Acres Cut	% Chg	Acres Cut	% Chg	Acres Cut	% Chg	Acres Cut	% Chg
Beach Fringe	7,359	7,359	0	0	0	0	0	0	0	0	0	0	0	0
Estuary Fringe	8,695	8,695	0	0	43	<1	60	<1	94	1	49	<1	119	1
Riparian	12,294	12,294	0	0	18	<1	48	<1	39	<1	7	<1	80	<1
Old-Growth VC 4-7	26,141	24,178	0	0	1,160	5	1,900	8	2,891	12	2,261	09	4,225	17
Alpine/ Subalpine	3,115	3,115	0	0	0	0	0	0	0	0	0	0	0	0

SOURCE: USDA-Forest Service, GIS Data Base.

Note: < = less than; > = more than

Beach Fringe
None of the alternatives proposes any timber harvest within the 500-foot beach fringe zone.

Estuary Fringe
None of the alternatives were designed to harvest timber within the 1,000-foot estuary fringe zone. GIS analysis revealed that some slivers of units did extend into the estuary fringe. These units will be trimmed to conform to the estuary boundary between draft and final EIS.

Riparian
For the purpose of this analysis, riparian habitat was identified by using riparian soils, and the Riparian Area Prescriptions as shown in Appendix C. TTRA buffers, or 100-foot minimum buffers around lakes larger than five acres, are not proposed for harvest.

Old-growth Forest
Old-growth forest comprises 37,265 acres of which 24,178 acres is commercial forest (Volume Class 4-7) in the project area. Only impacts to commercial forest lands are addressed because these lands are considered to be important wildlife habitat. Within some harvest units are scattered patches of nonforested or low productivity forest types. The biggest difference among the alternatives is the total number of acres scheduled for harvest for

each particular alternative. Alternative 2 proposes to harvest 5 percent of the existing commercial old-growth forest. Alternatives 3, 4, 5, and 6 harvest 8, 12, 9, and 17 percent respectively. The effects of old-growth habitat loss on old-growth associated species are reflected in Habitat Capability for MIS later in this section. For a discussion of the amount of timber harvest by volume class, see the Silviculture and Timber section of this chapter.

Alpine/Subalpine

None of the action alternatives propose a timber harvest in the subalpine habitat.

Comparison of Alternatives: Effects on Habitat Capability

The previous section discusses changes to wildlife habitats used by the MIS. This section discusses how those changes in habitats affect the potential habitat capability for each MIS. As mentioned in the Affected Environment earlier in this section, the models that estimate the capability of habitats to support selected species are not necessarily accurate reflections of actual populations in the project area. Actual population levels are not known for a given period in time and probably never will be due to weather, hunting, trapping, disease, predation, and other related factors which are difficult or impossible to predict for any given time in the future. However, changes in amount and quality of habitat, as estimated by each MIS model, are considered reasonable predictors of long-term changes in a population trend that is associated with the amount and quality of the habitat only.

Several MIS show a habitat/use relationship with the size of preferred habitats. The wildlife models for this analysis take into account those patch-size relationships for Sitka black-tailed deer, marten, and hairy woodpecker, and are shown in the Biodiversity section. Direct impacts to black bears, otters, and bald eagles have been greatly reduced in all action alternatives through avoidance of timber harvest in beach fringe, estuary fringe, stream corridors, riparian, and alpine/subalpine habitats.

Alternative 1 would have no direct effect on habitat capabilities for any MIS. Tables WIL-7 through WIL-15 display the changes in habitat capabilities, measured against Alternative 1, that would occur under Alternatives 2 through 6.

Sitka Black-tailed Deer

Sitka black-tailed deer are dependent on low elevation, high volume, old-growth stands during severe winters, and are affected by proposed timber harvest under the action alternatives. Alternative 2 would decrease habitat capability 5 percent in the project area while Alternatives 3, 4, 5, and 6 would decrease habitat capability 7, 10, 9, and 15 percent, respectively (see Table WIL-7).

Second-growth canopy closure in timber stands 20 to 30 years after harvest may be delayed by thinning to promote forage production (Hanley et al. 1989). Second-growth forest management has been widely used in Southeast Alaska, but recent research has not documented benefits to Sitka black-tailed deer from thinning and canopy gaps.

Table WIL-7
Changes in Habitat Capability for Deer to Year 1998

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Habitat Capability*	2,017	1,924	1,879	1,807	1,873	1,713
Change in Capability	0	-93	-138	-210	-174	-304
Percent Change	0	-5	-7	-10	-9	-15

SOURCE: USDA-Forest Service GIS Data Base and interagency habitat capability model.

* Numbers do not incorporate Patch-size Effectiveness calculations.

Black Bear

Avoidance of beach fringe, estuary fringe, stream corridors, and riparian habitat with timber harvest helps protect some of the most important black bear habitat. Alternatives would harvest habitat capable of supporting an estimated two to eight black bear, representing a less than 3 to 10 percent decline in habitat capability (Table WIL-8).

Table WIL-8
Changes in Habitat Capability for Black Bear to Year 1998

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Habitat Capability	77	75	73	71	72	69
Change in Capability	0	-2	-4	-6	-5	-8
Percent Change	0	-3	-5	-8	-6	-10

SOURCE: USDA-Forest Service GIS Data Base and interagency habitat capability model.

Marten

The marten is an old-growth associated species that uses a wide range of old-growth volume classes, tree species, and landscape positions. Alternatives 2 through 6 would harvest habitat capable of supporting an estimated 4 to 13 martens, for a 5 to 15 percent decline in habitat capability (see Table WIL-9). Martens are easily trapped and can be over harvested, especially where trapping pressure is heavy (Strickland, et al., 1982) and not effectively controlled. Density of roads may affect the quality of habitat for marten through trapping, especially where there is potential of over trapping (Thompson 1988). Mean home range sizes reported for marten throughout their range are approximately 1 $mi.^2$ (2.6 $km.^2$) (Strickland, et al. 1982). Home ranges of males tend to be discrete but they overlap with the ranges of one or more females. Therefore, whenever roads are built within 2 mi. (3.2 km.) of the beach or built less than 2 mi. (3.2 km.) apart, a high risk exists that unregulated trapping on these roads will result in an over harvest of resident marten. It is assumed, therefore, that as road densities exceed 0.2 $mi./mi.^2$, densities of marten will decrease. As road densities approach 0.6 $mi./mi.^2$, marten densities could be reduced by as much as 90 percent due to greatly increased trapping pressure (Suring, et al. 1992). However, marten population reductions from trapping can be controlled by harvest regulations.

Road management objectives have been developed for the project area and can be found in Appendix J. Even with all proposed and existing roads closed to motorized traffic, there is still a potential for over harvesting marten since the project area is so accessible by boat.

Table WIL-9
Changes in Habitat Capability for Marten to Year 1998*

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Habitat Capability**	86	82	80	77	79	73
Change in Capability	0	-4	-6	-9	-7	-13
Percent Change	0	-5	-7	-10	-8	-15

SOURCE: USDA Forest Service

* Without road density effects.
** Numbers do not incorporated Patch-size Effectiveness calculations.

River Otter

The otter is another species that benefited from measures taken during unit design which limited timber harvest in beach fringe, estuary fringe, stream corridors, and riparian habitat. Alternative 6 would harvest habitat capable of supporting an estimated 1 otter (Table WIL-10).

Table WIL-10
Changes in Habitat Capability for River Otter to Year 1998

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Habitat Capability	52	52	52	52	52	51
Changes in Capability	0	0	0	0	0	-1
Percent Change	0	0	0	0	0	-2

SOURCE: USDA-Forest Service GIS Data Base and interagency habitat capability model.

Hairy Woodpecker

The hairy woodpecker is a primary excavator that prefers high volume, old-growth timber, but can also effectively use lower volume stands. Alternative 2 would decrease habitat capability 4 percent in the project area; Alternatives 3, 4, 5, and 6 would decrease habitat capability by 5, 10, 8, and 14 percent, respectively (Table WIL-11). Hairy woodpeckers may also benefit from snag retention in clearcuts as a mitigation of timber harvest (see Snag Abundance Analysis and Chapter 2 Mitigation).

Table WIL-11
Changes in Habitat Capability for Hairy Woodpecker to Year 1998 by Alternative

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Habitat Capability*	890	855	841	800	818	763
Change in Capability	0	-35	-49	-90	-72	-127
Percent Change	0	-4	-5	-10	-8	-14

SOURCE: USDA-Forest Service GIS Data Base and interagency habitat capability model.

* Numbers do not incorporate Patch-size Effectiveness calculations.

Snag Abundance Analysis

TLMP Draft Revision (1991a) Standards and Guidelines call for maintaining a minimum of 275 snags per 100 acres of forested habitat for cavity nesting wildlife species. An analysis was completed for all VCUs within the project area to determine if prior harvest has reduced the number of snags below Forest Standards and Guidelines.

This analysis was accomplished by using a snag density of snags per acres for all the Volume Class 4-7 acres in each VCU. Areas that had been previously harvested were assumed to have no snags. In existing old-growth forest, the maximum number of snags per acre assumed to be useable was eight per acre, although more probably exist. It was assumed that more than eight snags per acre was in excess of nesting and courtship needs of the hairy woodpecker, which was the MIS chosen to represent cavity dwellers and users of snags for the Chasina Project Area; although, these snags could be used by other wildlife species. The analysis indicates that there is an adequate number of snags existing in VCUs 674, 678, 679, and 682. Some VCUs—677, 680, and 681— were identified as needing further analysis to confirm adequate distribution of snags. This was due to past timber harvest on other ownership or because proposed units were the only source of snags in the immediate vicinity (proposed units harvested a stringer of timber surrounded by non-commercial timber).

Based on map and photo review, the following units have been identified for snag retention, to maintain a good distribution of available snags:

Unit #	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
677-301						X
677-302						X
677-305						X
677-311						X
677-315						X
677-319						X
677-327						X
677-328						X
679-441	X	X	X	X	X	X
679-392				X		X
680-330		X	X		X	X
681-322		X	X	X		X

Brown Creeper

The brown creeper prefers large old-growth trees. All action alternatives would remove habitat capable of supporting an estimated 71 (Alternative 2) to 272 (Alternative 6) brown creepers (Table WIL-12). Alternative 2 would decrease habitat capability by 7 percent, while Alternatives 3, 4, 5, and 6 would be 5,10, 8, and 14 percent, respectively.

Table WIL-12
Changes in Habitat Capability for Brown Creeper to Year 1998

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Habitat Capability	1,947	1,876	1,855	1,754	1,782	1,675
Change in Capability	0	-71	-92	-193	-165	-272
Percent Change	0	-7	-5	-10	-8	-14

SOURCE: USDA-Forest Service GIS Data Base and interagency habitat capability model.

Vancouver Canada Goose

The Vancouver Canada goose nests in forested areas in proximity to open water and preferred food plants. The action alternatives would harvest habitat capable of supporting an estimate of between six (Alternative 2) and 25 (Alternative 6) geese in the project area. The action alternatives would decrease habitat capability 3 to 11 percent in the project area (Table WIL-13).

Table WIL-13
Changes in Habitat Capability for Vancouver Canada Goose to Year 1998

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Habitat Capability	222	216	210	204	208	197
Change in Capability	0	-6	-12	-18	-14	-25
Percent Change	0	-3	-5	-8	-6	-11

SOURCE: USDA-Forest Service GIS Data Base and interagency habitat capability model.

Bald Eagle

Scheduling development activities away from beach fringe, estuary fringe, lake buffers, and Class I and II streams will effectively reduce impacts to bald eagle nesting habitat. A one percent or less decrease in nesting habitat capability is predicted for any alternatives (Table

WIL-14). Management activities within 330 feet, ¼ mile, and ½ mile of an eagle nest site are restricted by an Interagency Agreement between the Forest Service and the U.S. Fish and Wildlife Service (USDA Forest Service and USDI Fish and Wildlife Service 1990). For a list of units that may have timber harvest activities restricted to certain time periods, see Chapter 2 Mitigation Measures.

Table WIL-14
Changes in Nesting Habitat Capability for Bald Eagle to Year 1998

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Habitat Capability	121	121	121	121	121	120
Change in Capability	0	0	0	0	0	-1
Percent Change	0	<1	<1	<1	<1	<1

SOURCE: USDA- Forest Service GIS Data Base and interagency habitat capability model.

Note: < = less than; > = greater than

Gray Wolf

The gray wolf habitat capability model runs off the Sitka black-tailed deer habitat capability model, since there are not any moose or mountain goats in the project area. The habitat capability does not include the effects of road density, due to the fact that all the road systems are isolated and are not connected to any large population centers. The Cumulative Effects section includes a discussion of effects that might be anticipated if a road system is connected to the Prince of Wales Island road system.

Table WIL-15
Changes in Habitat Capability for Gray Wolf to Year 1998

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Habitat Capability	5.8	5.5	5.4	5.2	5.3	4.9
Change in Capability	0	-.3	-.4	-.6	-.5	-1.1
Percent Change	0	-4	-7	-10	-9	-16

SOURCE: USDA-Forest Service GIS Data Base and interagency habitat capability model.

Comparison of Alternatives: Summary

Table WIL-16 summarizes the habitat capability for each MIS in 1954, 1996, and 1998. It also includes the percent change from 1954 to 1998.

Table WIL-16
Summary of Habitat Capability in the Year 1998 and Percent Change from 1954

			Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt. 6	
Species	**1954**	**1996**	**1998**	**% Chg**	**1998**	**% Chg**	**1998**	**% Chg**	**1998**	**% Chg**	**1998**	**% Chg**	**1998**	**% Chg**
Deer*	2,410	2,017	2,017	-16	1,924	-20	1,879	-22	1,807	-25	1,843	-24	1,713	-29
Black Bear	86	77	77	-10	75	-13	73	-15	71	-17	72	-16	69	-20
Marten*	97	86	86	-11	82	-15	80	-18	77	-21	79	-19	73	-25
Otter	52	52	52	0	52	0	52	0	52	0	52	0	51	-2
Hairy Woodpecker*	900	890	890	-1	855	-5	841	-7	800	-11	818	-9	763	-15
Brown Creeper	1,983	1,947	1,947	-2	1,876	-5	1,855	-6	1,754	-12	1,782	-10	1,675	-16
Vancouver Canada Goose	242	222	222	-8	216	-11	210	-13	204	-16	208	-14	197	-19
Bald Eagle	123	121	121	-2	121	0	121	0	121	0	121	0	120	-1
Gray Wolf	7	5.8	5.8	-16	5.5	-21	5.4	-23	5.2	-26	5.3	-24	4.9	-30

SOURCE: USDA-Forest Service GIS Data Base and interagency habitat capability model.

* Numbers do not incorporate Patch-size Effectiveness calculations (see the Old-Growth/Biodiversity section).

Cumulative Effects: Reasonably Foreseeable

This portion of the analysis (reasonably foreseeable) will focus on effects to the year 2004, which is halfway through the first rotation and the end of the KPC Long-term Contract. The TLMP RSDEIS (1996a) considers cumulative effects for 150 years and is incorporated here by reference.

Habitat capability was not calculated for State and private lands. This will represent a maximum potential impact, because even if these lands are harvested, they would be providing at least some minimal habitat capability.

Alternative 6 is used to display the reasonably foreseeable future actions because this is the maximum harvest alternative, and volume not harvested in other action alternatives could be harvested as part of another project by the year 2004.

Table WIL-17 shows the direct effects on habitat capability for MIS of the reasonably foreseeable actions from 1954 through 2004, using Alternative 6 as being equal to the total effects of the reasonably foreseeable actions of all the other alternatives.

Table WIL-17
Reasonably Foreseeable Direct Changes in Habitat Capability for MIS, 1954-2004.

Species	Habitat Capability 1954	Habitat Capability 1996	Habitat * Capability 2004	Percent * Reduction From 1954
Sitka Black-tailed Deer **	2,410	2,017	1,713	-29
Black Bear***	86	77	69	-20
Marten ** ***	97	86	73	-25
River Otter	52	52	51	-2
Hairy Woodpecker **	900	890	763	-15
Brown Creeper **	1,983	1,947	1,675	-16
Vancouver Canada Goose	242	222	197	-19
Bald Eagle	123	121	120	<-1
Gray Wolf	7	5.5	4.9	-30

SOURCE: USDA-Forest Service GIS Data Base and interagency habitat capability model.

* Based on Alternative 6, because Alternative 6 is the maximum harvest amount.
** Numbers do not incorporate Patch-size Effectiveness calculations (see Old-Growth/Biodiversity Section).
*** Does not consider effects of road densities.

Total Cumulative Direct and Indirect effects of Habitat Capability for MIS of Proposed Alternatives in 2040

Decreases in habitat capabilities projected to the end of the long-term contract in 2004 are displayed in Table WIL-17. Alternative 6 is used to display the reasonably foreseeable future actions because this is the maximum harvest alternative, and volume not harvested in other action alternatives could be harvested as part of another project by the year 2004.

The total cumulative direct and indirect effects are displayed in Table WIL-18; this takes into account the effects of canopy closure on units harvested by all alternatives and all other stands that are currently in the clearcut stage and converting them to the second growth.

Table WIL-18
Total Cumulative Direct and Indirect Effects of Habitat Capability for MIS for the Proposed Alternatives of This EIS by 2040 (assuming no further timber harvest)

			Habitat Capability 2040					
Species	**Habitat Capability 1954**	**Habitat Capability 1996**	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
Sitka Black-tailed Deer*	2,410	2,017	2,017	1,842	1,758	1,623	1,691	1,447
Black Bear ** (20 percent reduction)	86	62	62	60	58	57	58	55
Marten* **	97	69	69	26	8	8	8	7
River Otter	52	52	52	52	52	52	52	51
Hairy Woodpecker*	900	890	890	855	841	800	818	763
Brown Creeper	1,983	1,947	1,947	1,876	1,855	1,754	1,782	1,675
Vancouver Canada Goose	242	222	222	216	210	204	208	197
Bald Eagle	123	121	121	121	121	121	121	120
Gray Wolf	7	5.8	5.8	5.3	5.1	4.7	4.9	4.2

SOURCE: USDA-Forest Service GIS Data Base and interagency habitat capability model.

* Numbers do not incorporate Patch-size Effectiveness calculations (See Old-Growth/Biodiversity Section).
** Does consider effects of road densities.

Road Density Effects Analysis
The cumulative analysis also displays the effect a road connection between the project area and the Prince of Wales Island road system would have on wildlife species, such as gray wolf, black bear, and marten. For this part of the analysis, it is assumed that the project area is connected to the Prince of Wales Island road system.

The project area includes 67.7 square miles of National Forest Land. Using Alternative 6 as the maximum amount of road in the project area, there is a potential for 87 miles of roads (for a density of 1.28 miles of road per square mile of land).

Gray Wolf
Concern has been expressed that high road densities and liberal hunting regulations can result in over-harvest of the wolf population. TLMP Revision (1991a) Standards and Guidelines recommend a mitigation measure: consider an open-road density of 1 mile per square mile of

road, or in WAAs that adjoin Wilderness or roadless areas of greater than 247,000 acres (which this project area does), consider allowing open-road densities of up to 1.2 miles of Forest development roads per square mile of roaded area.

If it is assumed that all existing and proposed roads in the project area are open, the open-road density in the project area would be 1.28 miles of road per square mile (87 miles of road divided by 67.7 square miles), over the recommended road density of 1.2 miles of open road per square mile.

Black Bear

Although black bears can adapt to changes in their environment induced by humans, increased access by humans often leads to increased human-related mortality (legal harvest, poaching, and defense of life and property). The black bear habitat capability model has factors that attempt to take this increased mortality into consideration.

For habitat that is linked to a transportation system, the habitat capability of the areas within 2 miles is reduced by 20 percent. For the analysis of the effect of road density, it is assumed that all areas of the project area are within two miles of a road. So the black bear habitat capability would be reduced by 20 percent. Table WIL-18 displays the effect of connecting some of the project area road system to the Prince of Wales road system.

Marten

There is also concern that marten densities will decrease (due to their susceptibility to over trapping) as road densities exceed 0.2 miles of road per square mile. Marten densities will be reduced 90 percent as road densities approach 0.6 miles of road per square mile (Suring et al. 1992).

Again, assuming that all of the existing and proposed roads of the project area for all alternatives are open, the open-road density for Alternative 2 would be .5 miles of road per square mile (31 divided by 67.7). Comparing the open-road density to the Road Density Graph in the Marten Habitat Capability Model (Suring et al. 1992), the suitability index for marten based on road density is 0.3, so 0.3 was multiplied by the marten model outputs to make adjustments for road densities (see Table WIL-18). Miles of road for the remaining alternatives are: Alternative 3 = 62.1; Alternative 4 = 42.4; Alternative 5 = 56.1; and Alternative 6 = 86.7 for a road density of .9, .62, .83, and 1.28, respectively. Alternatives 3-6 would reduce marten habitat capability to 10 percent. The open road density severely impacts the marten habitat capability, indicating that there is a potential to over harvest marten in the project area if it is ever connected to the Prince of Wales road system or receives heavy trapping pressure by trappers using boats.

Table WIL-19 displays the impacts of harvesting the scheduled acres of the suitable-available forest lands in the 150-year planning period and assumes all harvested stands are in the closed canopy, second-growth condition.

Table WIL-19

Total Cumulative Changes Caused by This and Future Timber Sales, in Habitat Capability for MIS to the Year 2140

Species	Habitat Capability 1954	Habitat Capability 1996	Habitat Capability 2004*	Percent Reduction From 1954	Habitat Capability 2140**	Percent Reduction From 1954
Sitka Black-tailed Deer**	2,140	2,017	1,713	29	1,273	47
Black Bear	86	17	69	20	54	37
Marten***	97	86	73	25	52	46
River Otter	52	52	51	2	46	12
Hairy Woodpecker***	900	890	763	15	406	55
Brown Creeper	1,983	1,947	1,675	16	887	55
Vancouver Canada Goose	242	222	197	19	160	34
Bald Eagle	123	121	120	2	116	6
Gray Wolf	7	5.8	4.9	30	3.7	47

SOURCE: USDA-Forest Service GIS Data Base and interagency habitat capability model.

* Based on Alternative 6, because Alternative 6 is the maximum harvest amount.
** Assumes harvest of all suitable-available forest lands identified by the TLMP Draft Revision, Alternative P (1991a) within the project area.
*** Numbers do not incorporate Patch-size Effectiveness calculation or road density reductions.

Old Growth and Biodiversity

Key Terms

Biodiversity—the variety and abundance of life forms, processes, functions, and structures, including the relative complexity of species, communities, gene pools, and ecosystems at spatial scales that range from local through regional to global.
Canopy—the middle and uppermost layers of foliage in the forest.
Corridor—a patch or strip of habitat linking or providing connectivity between larger patches.
Edge—the biological and abiotic actions operating at edges; examples are—differences in microclimates, species, richness, productivity, and predation. A boundary between two distinct ecosystems, such as between forest and muskeg.
Forage—to search for food.
Fragmentation—reducing the size and connectivity of habitat patches; the degree and impacts of fragmentation depend on scale (in space and time) and the life requirements of the affected species.
Habitat Capability—an estimated number of animals that a habitat could potentially sustain.
Patch—an assemblage of similar vegetation, such as old-growth forest.
Planning Area—for the purpose of analyzing viable populations, the planning area is the ecological province, i.e., North Central Prince of Wales Province and South Prince of Wales Province.
Snag—standing dead tree.
Viable Population—a population with the estimated numbers and distribution of reproductive individuals to maintain the population over time.

Affected Environment

Old-Growth Forest

The definition of old-growth forest varies by habitat and includes such factors as age and size of trees, spacing, snags, canopy layers and structure, and the amount of down (on-the-ground) material (USDA Forest Service 1991a).

Old-growth stands have an uneven appearance because they contain trees of many ages, sizes, and condition, and contain numerous dead tops and snags. Based on past forest inventories, old-growth stands are assumed to have reached an equilibrium where timber growth equals mortality (USDA Forest Service 1991a). Tree establishment largely depends on large woody debris (logs and stumps) (Harmon 1986, Harmon and Franklin 1989) and gap formation (Alaback 1988). Woody debris provides micro sites for trees to grow on. Gaps created by windthrow or other disturbances allow light to penetrate to the forest floor. This process of tree death and replacement is continual; in any one year, a significant portion of the trees in individual stands are likely to blow down (Harris 1989). Thus, the forest is a mosaic of older and younger trees, dynamically changing yet remaining remarkably stable as a forested ecosystem (Bormann and Likens 1979, Alaback 1988, Schoen et al. 1988, Franklin 1990).

Old-growth forest is an important source of valuable forest products. Sitka spruce and western hemlock are suitable for the production of dissolving pulp, used in the manufacture of rayon, acetates, and other synthetic fibers. The high quality trees of these species, along with the cedars, provide some of the finest commercial timber for lumber, musical sounding boards, and other specialty products.

Old-growth forests also have become important to many people for aesthetic and cultural purposes. Large trees, characteristic of some old-growth stands, have become symbols of a pristine landscape.

Old-growth forest is also important wildlife habitat for old-growth associated species such as Sitka black-tailed deer, martens, black bear, Vancouver Canada geese, and cavity or snag-dependent species such as flying squirrels, woodpeckers, and owls. Many species have evolved to use the structural attributes of old-growth forests. The combination of a dense canopy with scattered small openings (typically 20 to 40 feet across) allows forage growth under openings, while the large limbs within the canopy intercept enough snowfall to provide winter food and thermal cover for deer and other species. The large, dense stems also provide some measure of thermal insulation in the winter, as well as during cold rains in the spring and summer. Large dead, dying, or diseased trees become nesting sites for martens, owls, eagles, wrens, and chickadees. These trees are also suitable as feeding sites for woodpeckers, sapsuckers, brown creepers, and others.

The value of old-growth forest for wildlife habitat is also thought to transcend individual stands. Large, contiguous, unfragmented blocks of old-growth forest are important to forest interior species, such as the northern goshawk and marbled murrelet. The large old-growth blocks provide expansive hunting territories and protection from predators, and promote genetic mixing among populations that would be less likely to breed if they were spatially separated by forest fragmentation. The large old-growth blocks are important winter range for deer.

Old-growth forests are an important, but decreasing, component of the temperate rain forest ecosystem. They differ in ecological function in many ways from younger, even-aged forests. Old-growth stands typically exhibit a wider variety of reproductive niches for species whose existence is thought to be old growth dependent, including certain animals, understory plants, and microorganisms which appear to be most successful when permitted to develop under at least a partially intact mature forest canopy.

Chasina Old-Growth Blocks

Within and immediately adjacent to the project area are large blocks of old-growth forest which are naturally fragmented due to mountains, alpine, and saltwater inlets. These blocks of old-growth forest are becoming more fragmented as a result of timber harvest (both of private and National Forest System lands). Figure OG-1 shows these and other large blocks of old-growth forest, while the Existing Condition Map in the separate map packet shows all remaining unharvested, old-growth, commercial forest within the project area.

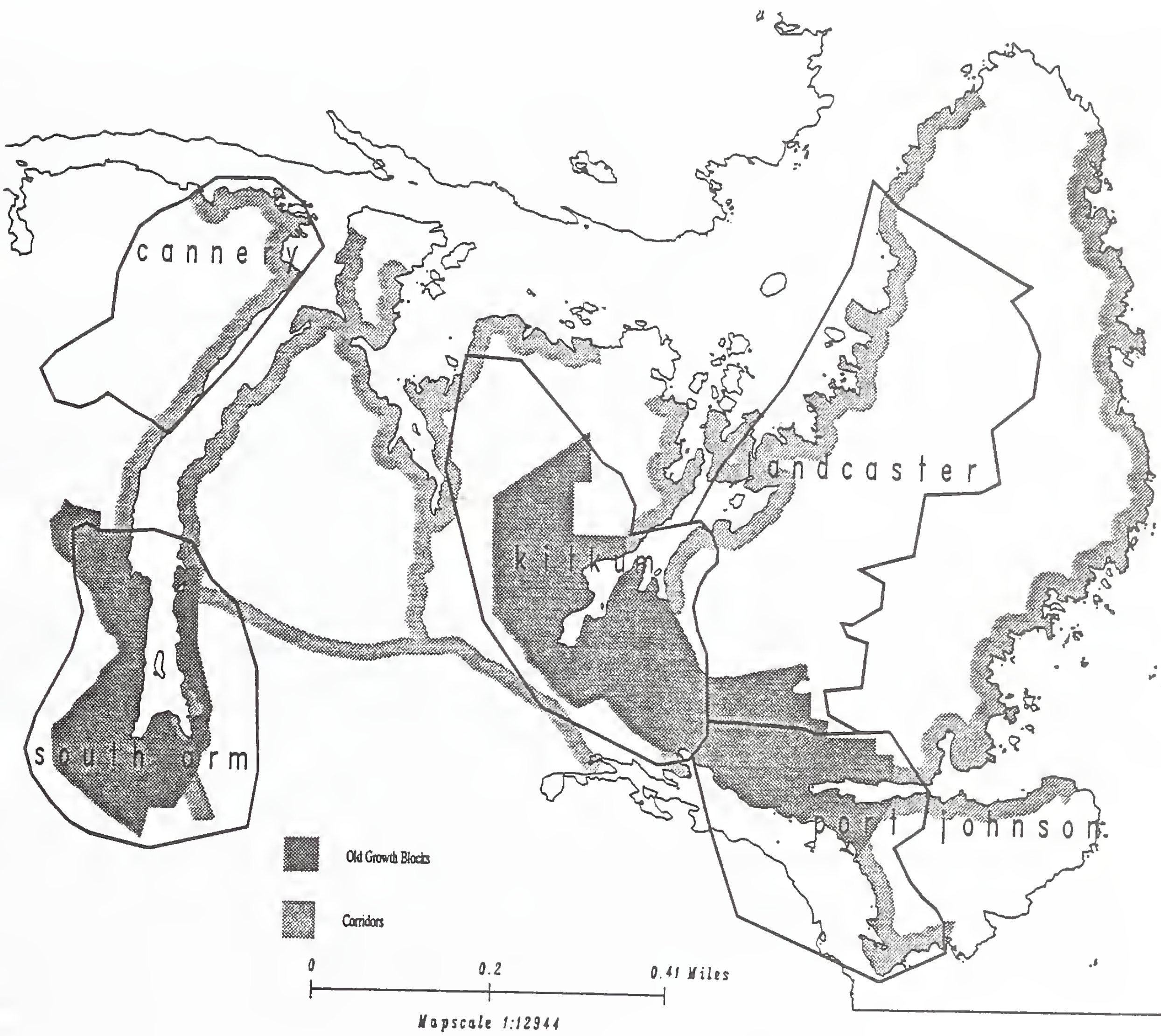
Table OG-1
Existing Old-growth Blocks in The Chasina Project

VCU	Name	Acres VC 4	Acres VC 5+
674/678	Cannery Creek	657	2,790
678	South Arm	574	2,777
679/682	Kitkun Bay	1,346	3,955
681/682	Port Johnson	726	1,493
679	Lancaster	1,658	4,777
Total		**4,961**	**15,792**

SOURCE: USDA-Forest Service, GIS Data Base

It is recognized that maintaining appropriate habitat corridors or connections between blocks of old-growth forest habitat is important to minimize isolation and gradual decline of wildlife species associated with the old-growth blocks (Harris 1984, 1985; Hunter 1990). Some of the corridors between these blocks have been affected by previous timber harvest activities. Figure OG-1 displays large blocks dominated by old-growth forest and areas that are important for maintaining connectivity between the large blocks.

Figure OG-1
Important Old-growth Blocks and Corridors



Other areas (including stands deemed inoperable for timber harvest because of unstable soils, steep slopes, economic isolation, or other factors) could also be interspersed and provide additional opportunities to connect old-growth blocks. While there has been historic timber harvest within the beach, estuary, and streamcourse buffers, these old harvest sites will mature in time and could provide travel corridors for some wildlife species for genetic interchange.

For additional discussion of old growth and connectivity, see Fragmentation and Connectivity later in this section.

Biological Diversity and Viable Populations

Biodiversity

National Forest Management Act (NFMA) regulations define diversity as the distribution and abundance of different plant and animal communities and species. Biological diversity, or biodiversity, refers not only to the variety of organisms in an area; it also includes their genetic composition, the complex pathways that link organisms to one another and to the environment, and the processes that sustain the whole system. Biodiversity plays a key role in how well an ecosystem functions. It can be evaluated at different scales, ranging from genetic diversity to landscape diversity.

Genetic diversity is the smallest scale. It refers to the variation in the genes of individual plants, animals, and microorganisms. There is concern when individuals of a species do not reproduce very well or do not show much variation among individuals. Species diversity refers to the variety of living organisms, ranging from beetles to bears, from mosses to massive trees. This scale not only includes the number of different species in an area, but also their abundance and distribution. Loss of genetic diversity and/or severe reductions in the size of populations can subject plant and animal species to increased risk of local extinction (extirpation).

This risk of genetic and species loss is higher if the structure, composition, or function of vital habitats are compromised. An example of such a compromise might be fragmentation of large blocks of suitable habitat into smaller isolated blocks that separate small populations of wildlife species from each other. In managing forest ecosystems, therefore, biodiversity management is often evaluated at larger scales. It is thought that conservation of functioning ecosystems will serve to conserve the species associated with them.

One of these larger scales of diversity “within-ecosystem” focuses on plant associations and habitat types and the diversity of plants and animals within those communities. This diversity scale usually measures the number of species present (richness) or the structural complexity of a given habitat type . For example, the number of breeding birds in Southeast Alaska has been shown to decline from 13 species in old-growth, spruce-hemlock forests to just three species immediately following logging (seedling/sapling stage) as vegetation structure and species composition become greatly simplified (Sidle 1985). As clearcuts (seedling/sapling stage) proceed to mid-successional stages (sapling/shrub and pole), species richness temporarily increases to 10 to 14 species, but declines again to seven species in older seral stages (young sawtimber) due to the loss of understory vegetation associated with canopy closure. Retention of snags, live trees, and down woody debris can be used to enhance within-ecosystem diversity by maintaining a portion of old-growth structure within regenerating stands (Sidle 1985, Della Sala 1993).

The next scale is "between-ecosystem" diversity, which describes the variation from one community to another in a particular area along environmental gradients. Southeast Alaska has a high between-ecosystem diversity, because natural forested patches are relatively small (compared to Oregon and Washington, for example) and are often interspersed in a matrix of muskegs. Large-scale logging can affect this diversity, because it increases the fragmentation of old-growth patches and is followed by a subsequent uniform age class of second growth that is quite different both from the adjacent old growth and from the muskeg matrix.

The largest scale considered is the diversity of ecosystems across a landscape, such as a province or biogeographic region. At this scale, differences in geology, for example the karst region on northern Prince of Wales, and climate come into play. Large areas of several million acres are evaluated and subdivided into ecological provinces and subprovinces (as in the TLMP RSDEIS, 1996a). An area is expected to support high levels of landscape diversity if viable populations of wildlife and habitat types are well distributed across the region. Evaluation of this scale of diversity is important for a number of reasons. Silviculturally, for example, a plant association on limestone-derived soils may respond differently following logging than the same plant association on glacial soils. The frequency of certain forest structural patterns (size and distribution of trees) may also differ on different soils, creating a variety of wildlife habitat.

Diversity is evaluated at all levels, because ignoring scale can lead to adverse effects on ecosystem function. For example, for years it was thought that maximizing forest fragmentation (the "staggered setting" approach) would benefit wildlife, because it maximized forest edges (boundaries between ecosystems). More recent research has found, however, that maximizing edge can ruin forest interior conditions critical for certain species (Forman and Godron 1986, Hunter 1990).

Ecosystem alteration, including habitat destruction, simplification, and fragmentation, is the most pervasive cause of biodiversity loss. Therefore, minimizing habitat alterations and promoting natural patterns help maintain biodiversity. To maintain biodiversity, large natural areas, corridors, and migration routes should be protected; removal of natural barriers should be avoided; areas that have already been developed should be utilized in place of altering undisturbed areas and restoring areas that have been altered. In natural resource management, it is sometimes necessary to focus on what is more limiting (e.g., large old-growth patches) or rare (e.g., possibly some plant or animal species), and to seek to maintain these aspects of the ecosystem, rather than to focus strictly on maximizing the number of species.

The amount of contiguous habitat, and the extent to which similar habitats connect by corridors, are considered key concepts in managing for biological diversity (Harris 1984, 1985; Hunter 1990). Due to the importance of unfragmented old-growth forest patches and the role of these areas in maintaining viable wildlife populations, old-growth habitat and an analysis of patch-size effectiveness will be used in this section as a tool to evaluate impacts on biodiversity.

A more detailed discussion of Tongass National Forest direction for managing biological diversity can be found in the TLMP Draft Revision 1991a, Vol. 149, pp. 3-9 to 3-45.

Viable Populations

Regulations developed to implement the National Forest Management Act of 1976 on National Forests state in part: "Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. For planning purposes, a viable population shall be regarded as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area" (36 CFR 219.19). Wildlife habitat planning and management for viable populations is carried out in the context of overall multiple-use objectives.

The task of maintaining habitats to support biodiversity has encompassed several methodologies, and alternatives continue to evolve. The existing TLMP (1979a) established old-growth habitat areas (retention and extended rotation) that were to be retained partially to maintain biodiversity. The first TLMP Draft Revision (1990) recommended protection of 24 percent of the CFL of each Wildlife Analysis Area, mostly in blocks of 1,000 to 10,000 acres. The TLMP Supplement to the Draft EIS (1991a) refocused its biodiversity and population viability management strategies at the ecological province level, and took a broader regional view. The Interagency Viable Population Committee of biologists made other recommendations, discussed below.

The TLMP (1979, as amended) does not locate retention habitats or contain specific habitat management standards and guidelines for maintaining habitat to support well-distributed viable populations of goshawks, wolves, or other individual wildlife species.

The TLMP (1979a) identified the need to set aside areas of operable commercial forest land for the protection of wildlife and fish that are dependent upon old-growth habitat for their survival. These areas are called Old-growth Prescription (retention) Areas. In addition to Old-growth Prescription Areas, additional old-growth areas would be designated to benefit wildlife through 2054 (the end of the first 100-year harvest rotation), in lands classified as follows (1989-94 Long-term Sale EIS):

- Inoperable commercial land.
- Lands in extended rotation.
- Lands in Aquatic Habitat Management old-growth prescriptions.
- Lands reserved for recreation purposes.

Under the TLMP RSDEIS (1996a), a variety of different LUDs preserve particular old-growth areas from timber harvest (i.e. Beach Fringe and Estuary, Stream Protection, LUD II, Special Interest Areas). This designation of no-harvest LUDs is intended to allow for seasonal wildlife migration from lowland to higher elevation ranges, to provide adequate acreage for forest interior and old-growth dependent species, and to facilitate genetic exchange between wildlife populations.

The TLMP Draft Revision provides for regional management and maintenance of population viability at the planning area level. "Planning Area," for defining viable populations, is the ecological province level (TLMP RSDEIS 1996a). Under TLMP, individual project areas are not expected to independently maintain viable populations, but only to contribute to and not cause a decline of overall viable populations. However, their contribution to well-distributed

populations through the maintenance of connectivity can be critical. Standards and guidelines outline prescriptions for maintaining biodiversity at the project area level (TLMP RSDEIS 1996a).

The Chasina Project Area lies within the South Prince of Wales Island Biogeographical Province (#18), as defined by TLMP RSDEIS (1996a). This province is comprised of 159,435 acres of productive old growth, of which 82 percent are designated for preservation in a natural setting under the terms of the Preferred Alternative for the TLMP RSDEIS (1996a). These areas are composed largely of LUD I and II areas, as well as buffers for beach fringe, estuaries, streams, riparian management areas, and eagle nests.

Figure OG-2 illustrates the setting of the project area within the South Prince of Wales Island Biogeographical Province (No. 18).

Figure OG-2
South Prince of Wales Ecological Province, No. 18

This province is comprised of 370,594 acres, of which 85,481 acres are designated for preservation in wilderness areas in the Preferred Alternative of the TLMP RSDEIS (1996a).

VPOP Committee

In an effort to further refine the methodology by which viable populations are maintained, an interagency committee of wildlife biologists appointed by the Forest Service was assembled (Viable Population [VPOP] Committee) to assess whether some species associated with old-growth forests required special standards and guidelines to ensure that their populations remain viable and well distributed across their current ranges on the Tongass National Forest. The VPOP Committee's draft recommendations were reviewed by the management-level Steering Committee on Viable Populations (Capp et al., October 1991). The VPOP Committee focused on viability risk assessments that could be applied to the evaluation of planning alternatives Forest-wide. The VPOP Committee recommended habitat conservation areas (HCAs) of three sizes: large, medium, and small (Suring et al. 1993). The three different HCAs could be applied to individual planning areas or to multiple planning areas provided sufficient connecting corridors are present to permit dispersal of wildlife across HCAs. The committee formulated criteria for establishing HCAs.

For a large HCA, a tract should include at least 20,000 acres of old growth with over 8 MBF per acre, including at least 10,000 acres with over 20 MBF per acre within a tract of at least 40,000 acres. Large HCAs should be no more than 20 miles apart, edge-to-edge, to ensure effective dispersal between them. HCAs with these characteristics are believed to be necessary to ensure that viable populations of wide-ranging species such as marten are well distributed within an analysis area.

A medium HCA would encompass at least 5,000 acres of old-growth forest with over 8 MBF per acre, including at least 2,500 acres of old-growth forest with over 20 MBF per acre within a tract of at least 10,000 acres. Medium HCAs would be capable of supporting at least five female martens during winters of poor prey (Suring et al. 1992).

Small HCAs would include at least 800 acres of old-growth forest having over 8 MBF per acre within a tract of at least 1,600 acres. Small HCAs would be capable of supporting at least one female marten during winters of poor prey. Small HCAs are maintained to provide temporary functional habitat for wildlife dispersing between large and medium HCAs. The small HCAs also contribute to the landscape matrix between large and medium HCAs.

The March 1996 Revised Supplement Draft (RSDEIS) preferred alternative would maintain wildlife populations through a complex of large, medium, and small old-growth habitat reserves laid out across the Tongass National Forest totaling one million acres, outside congressionally designated areas. This strategy implements the concepts recommended by the VPOP Committee. Within the Chasina Project Area, two blocks of old-growth forest were recommended to be retained as a HCAs: the Nutkwa LUD II HCA (approximately 38,300 acres), includes a small portion of the project area on the South Arm of Cholmondeley sound. The Kitkun Bay medium HCA (approximately 10,400 acres) lies in the middle of the project area.

On July 27, 1995, the President signed into effect Public Law 104-19. Section 502(a) of this law states: "No funds available to the Forest Service may be used to implement Habitat Conservation Areas in the Tongass National Forest for species which have not been declared threatened or endangered pursuant to the Endangered Species Act, except that with respect to goshawks the Forest Service may impose interim Goshawk Habitat Conservation Areas not to exceed 300 acres per active nest consistent with the guidelines utilized for national forests in the continental United States." In response to this legislation, this project will not implement

the HCAs as recommended by the VPOP Committee. However, to address issues raised by the public, the effects on these HCAs will be displayed for each alternative in this EIS.

Fragmentation and Connectivity

The extinction of species is a serious and irreversible threat. Habitat loss and fragmentation are prime causes of extinction today. Fragmentation occurs whenever a large continuous habitat is transformed into smaller patches that are isolated from each other, such as occurs from catastrophic windstorms or from extensive clearcutting. The changed landscape functions as a barrier to dispersal for species associated with the original habitat. These smaller and more isolated habitats also support smaller populations, which are more vulnerable to local extinction.

Research shows that forest fragmentation results in an increased ratio of forest “edge” to forest “interior” habitat, and can have a strong negative effect on forest interior species. One such effect is that as more edge habitat becomes available, as a result of fragmentation, the edge-dwelling species invade the interior environment and become a major threat to the survival of the forest interior species. Rosenberg and Raphael (1986) recommended a minimum stand size of 50 acres when delineating old-growth habitat, and suggested that when a stand is greater than 50 percent isolated, the minimum stand size should be 124 acres. By maintaining large contiguous blocks of habitat, the forest interior species would realize less competition and predation from open forest and edge species.

Patch Sizes

The analysis of forest fragmentation in the Chasina Project Area was based on the total number of old-growth forest patches within specific size classes. Patch-size classes were selected to represent MIS requirements based on the species patch-size effectiveness curves (Tables OG-2 and OG-3; see also explanation on next page). Old-growth forest patches were defined as the amount of contiguous old growth of Volume Class 4 and above.

Table OG-2
Patch-Size Relationships

Patch Size (Acres)	Species Relationship
0-25	Incorporates optimal patch size for red squirrel
26-100	Incorporates optimal patch size for brown creeper
101-500	Incorporates optimal patch size for marten
501-1,000	Incorporates optimal patch size for woodpeckers
> 1,000	Incorporates optimal patch size for deer

SOURCE: Workshop to recommend patch-size relationship and corridor requirements for the MIS and TES species.

Table OG-3
Patch-Size Effectiveness Values by Patch Size Class and by Species

			Patch Size	Classes (Acres)	
Species	**0-25**	**26-100**	**101-500**	**501- 1,000**	**> 1,000+**
Sitka Black-tailed Deer	0.3	0.35	0.5	0.83	1.0
Marten	0.2	0.5	1.0	1.0	1.0
Hairy Woodpecker	0.1	0.42	.7	1.0	1.0
Brown Creeper	0.8	1.0	1.0	1.0	1.0

SOURCE: Workshop to recommend patch size relationships and corridor requirements for the MIS and TES species.

* Represents the median curve value within each patch size class from the species effectiveness curves.

Patch-Size and Corridor Requirements of MIS and TES Species

An interdisciplinary group of biologists from ADF&G, Forest Service, and the U.S. Fish & Wildlife Service (1989) categorized management indicator species (MIS) and threatened and endangered species (TES) into one of three groupings based on how the species generally utilize or respond to their environment with regard to needing minimum habitat patch sizes and/or dispersal corridors.

Landscape

Wildlife species in this category generally have large seasonal or year-long home ranges and territories. These species are capable of utilizing a wide variety of vegetative conditions, although preferences for certain vegetation types exist which provide a higher quantity/quality of forage or cover needs. These species will travel or move through a wide variety of habitats to utilize their environment; therefore, these species do not have specific patch-size or corridor requirements.

Community

Wildlife species in this category generally have smaller home ranges and territories than the landscape species. These species show a high preference or requirement for a particular vegetation community or combination of communities, especially during the season of the year that is considered critical. Preferred or required habitats may need to be within mean dispersal distances of the species, and corridors may be needed. These species generally show a relationship with patch size of the preferred or required habitats. In some situations, as patch sizes are reduced, a species may be replaced by another species which can more effectively use the habitat.

Structural
Wildlife species in this category require a specific or unique habitat element or site, such as a pond or cliff for nesting. Often, the size, location, and abundance of these sites are the result of natural geologic or climatic events rather than the effects of management.

Each of the MIS and TES species that occurs within the Chasina Project Area was placed within one of the above groups, as follows:

Landscape	Structural	Community
Black bear	Bald eagle	Marten
Gray wolf	Trumpeter swan	Hairy woodpecker
River otter	Peregrine falcon	Brown creeper
		Marbled murrelet
		Vancouver Canada goose
		Sitka black-tailed deer

For the species within the landscape and structural groups, no specific patch-size or corridor requirements are needed. For the species within the community category, the committee identified types of vegetative communities or habitats that are applicable to patch-sizes and corridor requirements for each species. These include:

Marten: patch size includes the acres of all conifer stands from older second growth and all CFL, old growth; corridor requirements include all conifer stands from older pole timber through old growth.

Hairy woodpecker: patch size includes all old-growth conifer stands plus older second-growth stands; there are no corridor requirements for this species.

Brown creeper: patch size includes all volume class 5+ old-growth conifer stands; there are no corridor requirements for this species.

Marbled murrelet: patch size includes all old-growth conifer stands; there are no corridor requirements for this species, as it has been observed flying in the subalpine and alpine habitats.

Vancouver Canada goose: adequate information was not available to develop patch-size relationship for this species. These birds are highly mobile and are found throughout the islands of Southeast Alaska. No vegetative corridor requirements have been identified.

Sitka black-tailed deer: patch size includes all old-growth stands; no specific corridor requirements were developed.

The relationship of patch size to the effectiveness of that habitat to support a particular species was analyzed, and index graphs were developed. Table OG-4 displays a summary of the effectiveness of various patch-size classes for the above Chasina MIS species.

Prior to timber harvest, the project area contained extensive amounts of unfragmented forest patches (Figure OG-3, map of distribution of forest patches in 1954, later in this section). Approximately 75 percent of the commercial forest land throughout the project area was in forest patches greater than 1,000 acres. Timber harvest has decreased the acreage in this patch size class from 19,612 acres to 14,215 acres. See Figure OG-3 for the 1954 condition and Figure OG-4 for the existing condition, Alternative 1.

Fragmentation of existing old-growth results in a reduction in the effectiveness of remaining patches as wildlife habitat. Individual species respond to natural and human-induced fragmentation differently. Species like brown creepers and hairy woodpeckers can be supported by smaller patches of forest habitat than species such as deer and marten (Proceedings of workshop to recommend patch-size relationships and corridor requirements for the MIS and TES species) (Table OG-3).

Patch-size effectiveness percentages for 1954, range from .983 percent (brown creepers) to .888 percent for deer (Table OG-4). The 1954 patch-size effectiveness was not 100 percent effective because many of the existing patches were not at the optimum size. The values for 1996 vary from .836 percent effective to .979 percent effective. The greatest difference in percent effectiveness between 1954 and 1996 was for deer.

Table OG-4
Adjusted Habitat Capabilities Based on Patch Size Effectiveness

Species	1954 W/o*	1996 W/o*	1954 With**	1954 Patch Effect %	1996 With**	1996 Patch Effect %
Sitka Black-tailed Deer	2,410	2,017	2,140	.888	1,686	.836
Marten	97	86	93	.960	81	.946
Hairy Woodpecker	900	890	828	.920	795	.893
Brown Creeper	1,983	1,947	1,949	.983	1,906	.979

SOURCE: USDA-Forest Service, MIS Habitat Capability Models.

* Without patch-effectiveness percent applied.
** With patch-effectiveness percent applied.
Note: Habitat capability is an estimated number of animals that a habitat could potentially sustain. It does not represent actual populations.

Connectivity

The connectivity, or corridors, between habitat patches in a landscape may be at least as significant to maintaining diversity as the size of the patches (Noss 1983). Forman and Godron (1981) defined corridors as being of four types: (1) line corridors, those which are all edge and possess no interior habitat; (2) strip corridors, those which maintain interior habitat; (3) stream corridors, those bordering a water source; and (4) network corridors, those which

intersect and form patterns. Corridors can function as more than one type; for example, when a stream corridor is wide enough to incorporate interior habitat, it also functions as a strip corridor. Forman and Godron's work also highlighted the fact that some interior species will not live in or even migrate through extensive lengths of unsuitable habitat, and that strip corridors were preferable to line corridors. Management of corridors as well as habitat patches should strive to mimic natural patterns (Noss and Harris 1986).

The main dispersal corridor throughout the project area are thought to be the beach fringe and saddles between mountains.

Currently, the old-growth blocks that consist of Port Johnson, Kitkun Bay, and Lancaster are all connected by beach fringe and inland old-growth forest. These blocks of old-growth forest provide the connectivity from the outside portion of the island along Clarence Strait to the Kitkun Bay area and along the coast up to Chasina Point. This is an important wildlife corridor since the wildlife corridor to Chasina Point on the Clarence Strait side of the peninsula has been heavily impacted by logging on private land and is probably not effective at this time.

The other two old-growth blocks in the project area (Cannery Creek and South Arm) are also currently connected by beach fringe forest. However, about 1-1/2 miles of beach fringe between these two blocks has been recently conveyed to Kootznoowoo Native Corporation and is in the process of being logged. The west side of South Arm is an important corridor because it provides the best link for animals in southern Prince of Wales Island to migrate north along the coast to Sulzer Portage (which connects South Prince of Wales to North Prince of Wales). There are two 800-foot elevation saddles that connect South Arm to Moira Sound and Klakas Inlet. The Sulzer Portage and Big Creek areas are also in the process of being logged. The Cannery Creek block has not had any prior timber harvest activity, while the South Arm block has had some low elevation stands that were A-frame logged about 20 years ago.

Effects of the Alternatives

Analysis conducted for the TLMP RSDEIS (1996a, Preferred Alternative) indicates approximately 82 percent of productive old-growth forest would remain distributed throughout the planning cycle (150 years) within the South Prince of Wales Island Biogeographical Province to potentially support viable populations of Management Indicator Species (MIS). All alternatives proposed by this EIS provide areas that would remain connected by beach fringe, estuary fringe, and stream corridors, and the myriad of oversteepened slopes and other areas unsuitable for timber harvest. Managed stands would change from multi-aged old-growth timber to even-aged stands of timber in early succession/understory colonization stage.

Following clearcut logging of old-growth forest, the stands that subsequently develop are even-aged (Harris and Farr 1974) and tend to contain a higher percentage of Sitka spruce and a lower percentage of the cedars. Clearcutting differs from natural disturbances in that it typically represents a large-scale change rather than dispersed, small, partial blowdown patches. It also differs in that nearly all trees are felled, whereas in natural disturbances many trees remain standing or partially standing (Hansen et al. 1991).

There has been a national concern over the limited and dwindling supply of old-growth forest, as exemplified by the spotted owl controversy in Oregon and Washington. Approximately 1.8 percent of the old-growth forest on National Forest System lands on South Prince of Wales Island has been harvested. Under the Preferred Alternative in the TLMP Revision, approximately 18 percent of the old-growth forest in the South Prince of Wales Island Ecological Province will be converted from old-growth forest to successive crops of younger trees which will be harvested before they mature into old-growth forest (TLMP RSDEIS 1996a). The subsequent crops of younger trees will yield more useable wood fiber per acre. At the same time, this conversion of old-growth forest to younger stands will cause some changes in the value of certain forest products, changes in value of wildlife habitat, reductions in diversity of ecosystem function and composition, and changes in inherent aesthetic qualities.

Fragmentation and Patch Size Effectiveness

To help identify important blocks of old-growth habitat, a map was generated using Geographic Information System (GIS) that displayed all blocks of old-growth timber volume class 4 and greater. The patches were then categorized into the various acreage classes. This procedure was completed for the years 1954 (prior to logging) and 1996 (the current condition, Alternative 1), and for Alternatives 2-6. These patches are displayed in Figures OG-3 through OG-9. Table OG-5 displays the acreage in each patch size class, for the year 1954, the existing condition (1996), and Alternatives 2-6.

Alternative 2 is the best alternative for maintaining the large blocks of old-growth habitat, while Alternative 6 has the most impact on large blocks.

Table OG-5
Patch-Size Acreage by Alternative and Acres of Interior Habitat

Alt.	>1,000 Acre Patches	501-1,000 Acre Patches	101-500 Acre Patches	26-100 Acre Patches	0-25 Acre Patches	Interior Habitat
1954	19,612	1,706	2,935	1,200	550	12,524
1	14,215	4,019	3,548	1,581	643	10,200
2	13,647	2,871	3,929	1,655	712	9,190
3	13,114	2,834	3,442	1,914	782	8,427
4	8,698	5,091	4,672	1,913	727	6,900
5	9,925	5,844	3,198	2,010	741	7,350
6	8,516	3,858	4,759	1,920	777	5,803

SOURCE: USDA-Forest Service, GIS Data Base

Table OG-6 displays the results of patch-size effectiveness for Sitka black-tailed deer, marten, hairy woodpeckers, and brown creepers (the Chasina MIS species with patch size criteria requirements). Note that none of the action alternatives are significantly different.

Table OG-6
Adjusted Habitat Capabilities Based on Patch Size and the Percent Effective by Alternative

Species	1954	Alt. 1 1996	Alt. 2 1998	Alt. 3 1998	Alt. 4 1998	Alt. 5 1998	Alt. 6 1998
Sitka Black-tailed Deer	2,140	1,686	1,585	1,539	1,382	1,469	1,297
% effective	.888	.836	.824	.819	.765	.797	.757
Marten	93	81	77	74	71	73	67
% effective	.960	.946	.939	.928	.927	.926	.920
Hairy Woodpecker	828	795	751	733	680	712	639
% effective	.920	.893	.878	.871	.850	.871	.837
Brown Creeper	1,949	1,906	1,829	1,803	1,705	1,746	1,628
% effective	.983	.979	.975	.972	.972	.980	.972

SOURCE: USDA Forest Service, GIS Data Base

Note: Habitat capability is an estimated number of animals that a habitat could potentially sustain. It does not represent actual populations.

Effect of Proposed Alternatives on Old-Growth Habitat in Chasina

Alternative 1 (the no-action alternative), maintains all old-growth blocks in their existing condition.

Table OG-7 is a summary of how the existing blocks of old-growth forest are affected by various timber harvest associated activities. Note that some blocks have different activities depending upon the alternative. For example, the Cannery Creek block has timber harvest, road construction, and LTF construction for Alternatives 3, 5, and 6; Alternative 4 harvests a similar amount of acreage, but it is all harvested by helicopter.

Table OG-7
Old-growth Blocks Impacted by Timber Harvest, Road Construction, and LTF Construction by Alternative

Old-growth Block	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Cannery Creek	N/A	N/A	1, 2, 3	1	1, 2, 3	1, 2, 3
South Arm of Chom.	N/A	N/A	N/A	1	1	1
Kitkun Bay	N/A	N/A	N/A	1, 2	1, 2	1, 2
Port Johnson	N/A	1	1, 2, 3	1	N/A	1, 2
Lancaster	N/A	1, 2	1, 2	1, 2	1, 2	1, 2

1 = Timber Harvest; 2 = Road Construction; 3 = New LTF Construction
Note: All alternatives maintain 500 foot beach buffer and 1,000 foot estuary buffer.

Figure OG-3 represents the pre-harvest (1954) condition, while Figure OG-4 represents the existing condition (Alternative 1), and Figures OG-5 through OG-9 show the effect that the alternatives would have on the existing large blocks of old-growth forest. Past timber harvest activity has reduced the amount of old-growth forest in blocks greater than 1,000 acres, resulting in a corresponding decrease in the total amount of old-growth forest that is in the project area. The action alternatives also reduce the amount of old-growth timber remaining in blocks greater than 1,000 acres.

Figure OG-3
Patch-Size Effectiveness, 1954

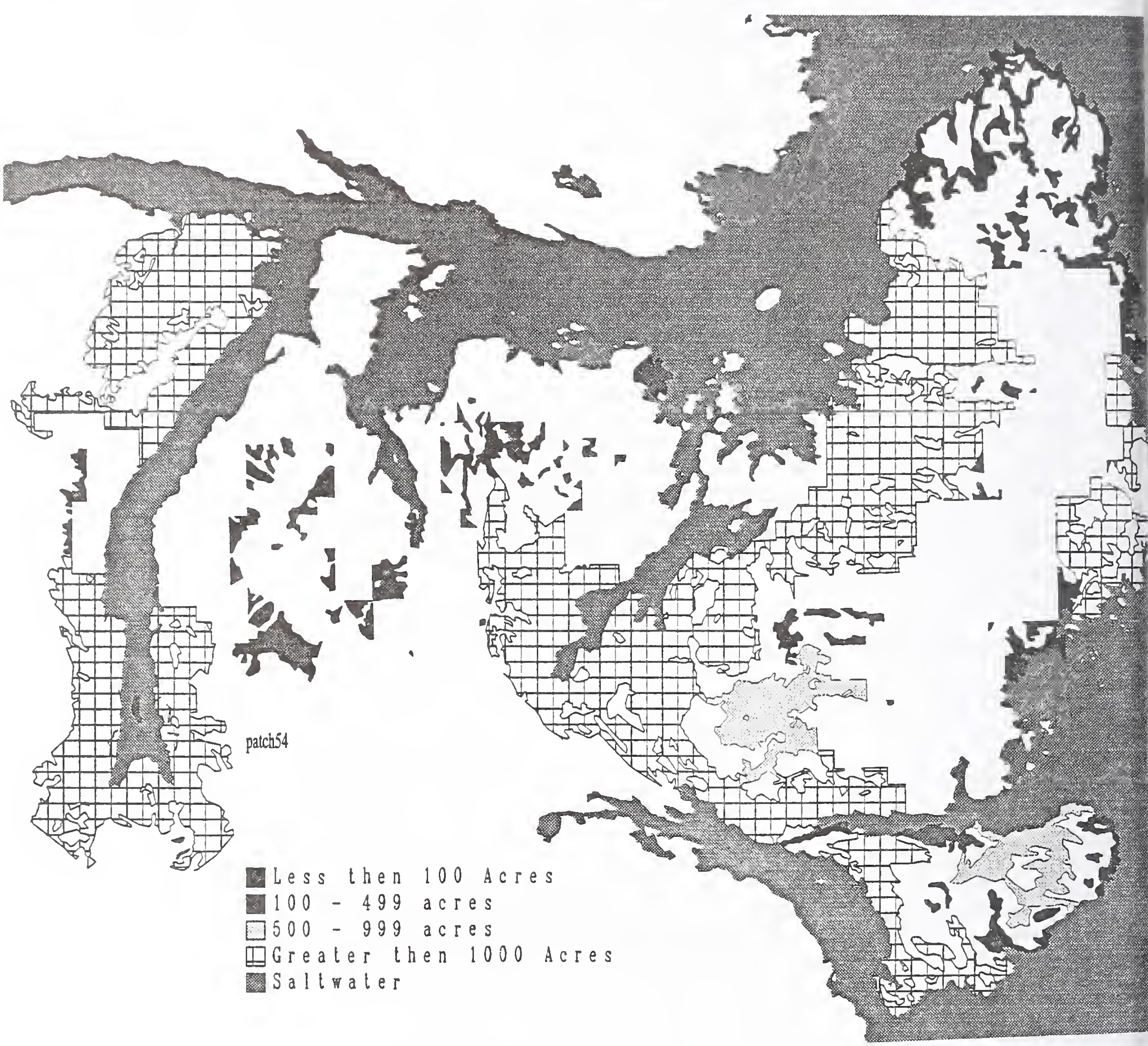


Figure OG-4
Patch-Size Effectiveness, Alternative 1

Figure OG-5
Patch-Size Effectiveness, Alternative 2

Figure OG-6
Patch-Size Effectiveness, Alternative 3

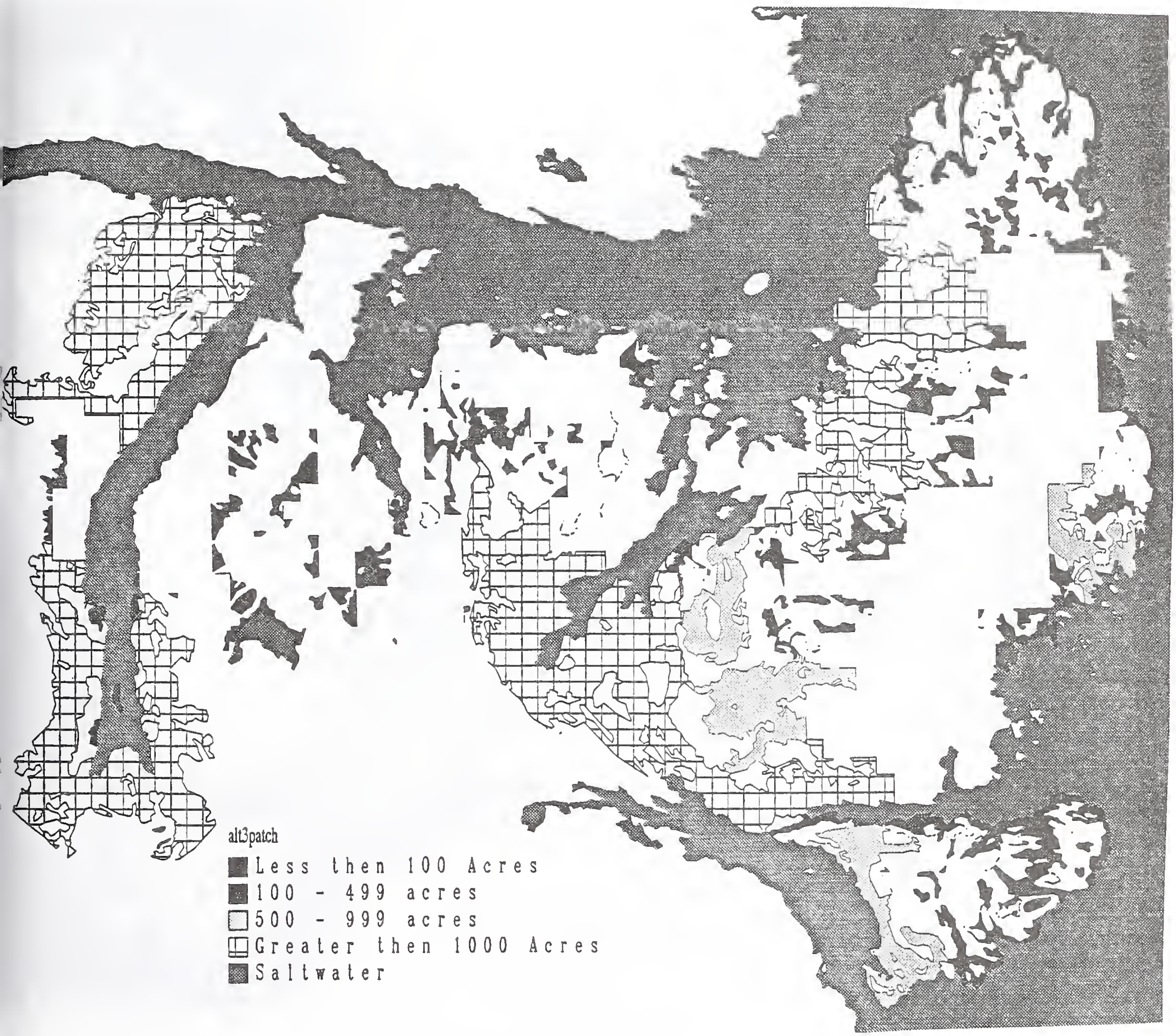


Figure OG-7
Patch-Size Effectiveness, Alternative 4

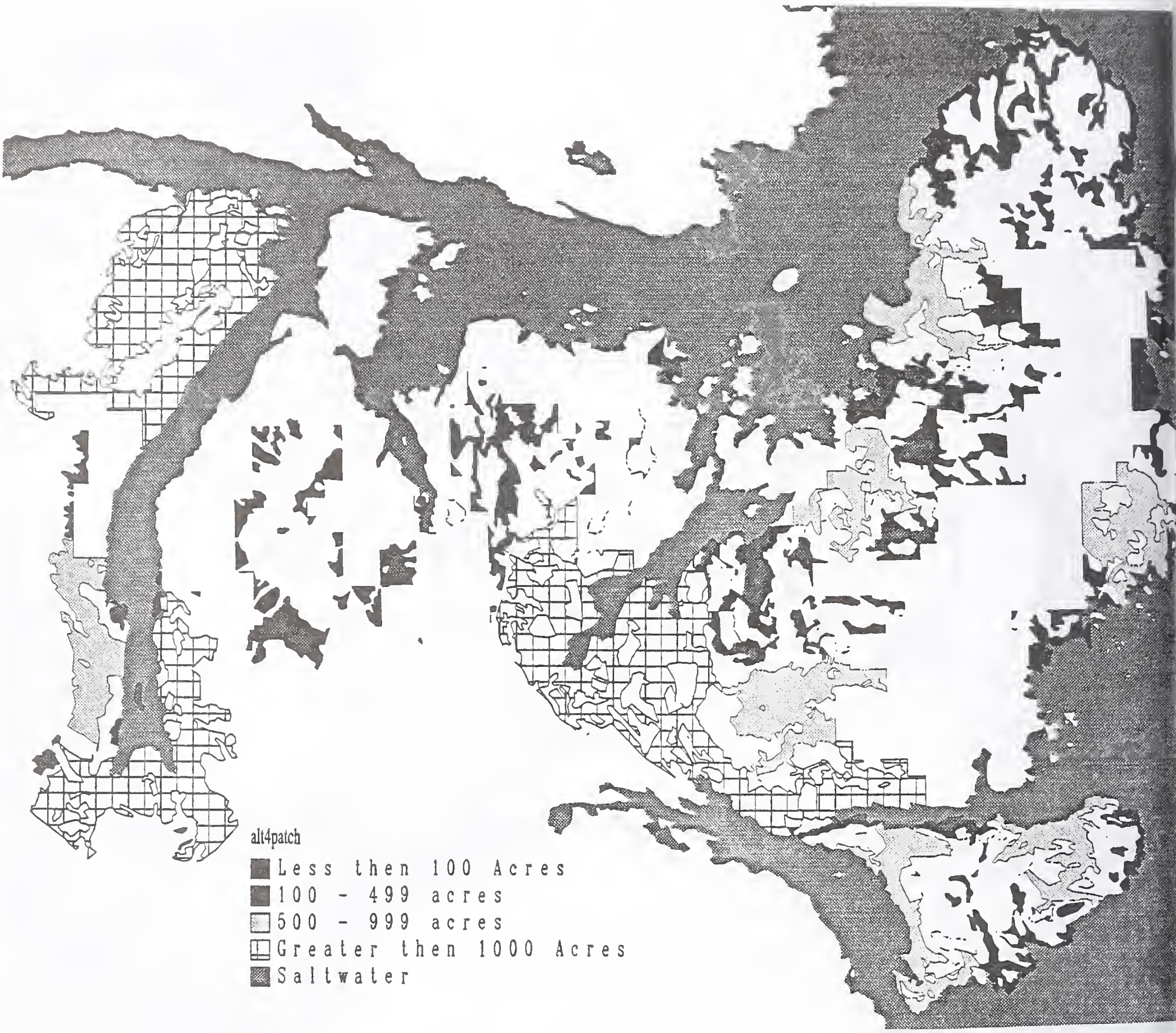


Figure OG-8
Patch-Size Effectiveness, Alternative 5

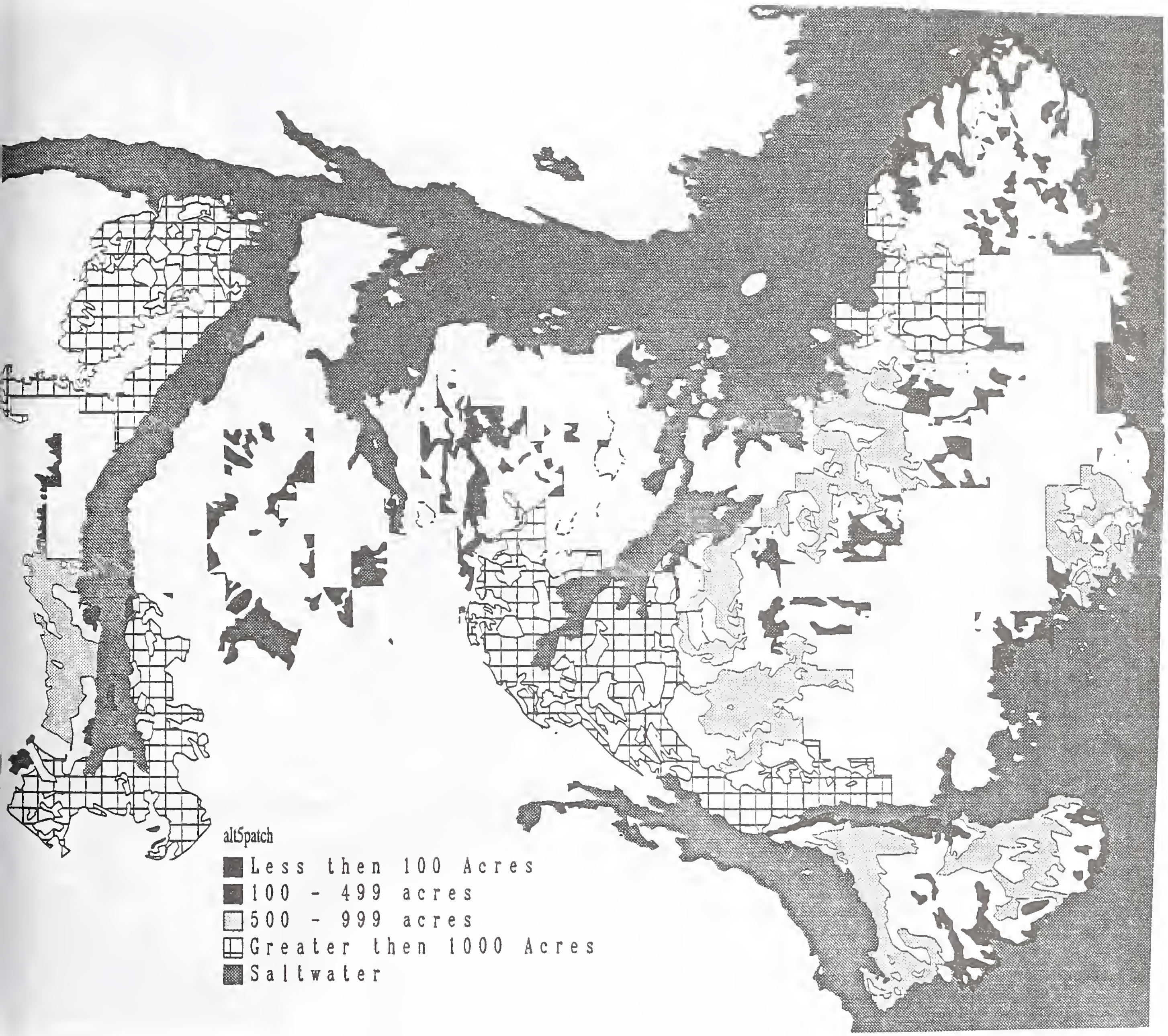


Figure OG-9
Patch-Size Effectiveness, Alternative 6

Effects of the Alternatives on Connectivity and Corridors

Kitkun Bay to Lancaster has been identified by the Alaska Department of Fish and Game and the US Fish and Wildlife Service as probably the most important wildlife corridor in the project area. It contains low elevation, high volume old growth adjacent to a large area that has been intensively harvested.

The South Arm corridor is also an important travel corridor for linking southern Prince of Wales Island to northern Prince of Wales Island via Sulzer Portage. Table OG-8 displays which alternatives impact these identified corridors.

Table OG-8
Corridors Impacted by Timber Harvest, Road Construction, and LTF Construction

Corridor	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
South Arm	N/A	N/A	1, 2, 3	1	1, 2, 3	1, 2, 3
Kitkun/Lancaster	N/A	1	1	1, 2	1, 2	1, 2

1 - Timber Harvest; 2 = New Road construction; 3 = New LTF Construction
Note: All alternatives maintain the 500 foot beach buffer and 1,000 foot estuary buffer.

Effects of the Alternatives on Viable Populations of Wildlife

Forest Plan land allocation on South Prince of Wales Island prohibits timber harvest in some of the Habitat Conservation Areas recommended to the TLMP Revision planning team (Suring et al. 1993) such as the large old-growth blocks that exist within the South Prince of Wales Wilderness Area, Nutkwa LUD II area, and areas identified for semi-primitive recreation in the Dickman Bay and McLean Arm areas. Alternatives 2 and 3 will not be affecting the HCAs identified in the "Draft Interim Habitat Management Guidelines for Maintaining Wildlife Viability on the Tongass National Forest," the size and spacing requirements identified in that strategy will be met. There are areas available to serve as small blocks of old-growth habitat in VCU 674 and Chasina Point for both alternatives.

It is assumed that maintaining the large old-growth blocks that are proposed by Alternatives 2 and 3 and adjacent areas will contribute to the maintenance of a well-distributed, viable population of wildlife. Alternatives 4, 5, and 6 result in a greater risk of the project area being able to contribute to the maintenance of well distributed, viable populations of wildlife because the size and spacing requirements identified in the V-POP strategy will not be met.

Mapped Old-growth Habitat (Retention Areas)

TLMP (1979, as amended) was designed to allow individual projects to set aside important wildlife habitat from the suitable timber base as reserved for wildlife. These areas have become termed as retention. No old-growth habitat (retention) has been mapped in the Chasina Project Area, although 801 acres are listed for VCU 679. The current strategy for

saving habitat for wildlife has focussed on retaining large blocks of unfragmented old-growth forest.

Comparison of Alternatives

Based on old-growth habitat and patch-size effectiveness, Alternative 1 would do the most to preserve the natural biological diversity of the project area and maintain natural ecosystem processes. Of the action alternatives, Alternatives 2 and 3 maintain the most acreage in large old-growth patches. There is not much difference among action alternatives when considering patch-size effectiveness, although Alternative 6 has the most impact.

Threatened and Endangered Species

Key Terms

Endangered—a species in danger of extinction throughout all or a significant portion of its range.
Threatened—a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
Species of Concern—a species or group of species being considered by the U.S. Fish and Wildlife Service for listing as endangered or threatened, but for which conclusive data is lacking on its biological vulnerability and degree of threat.
Sensitive—species (identified by the Forest Service) whose population viability is of concern on national forests within the region, and which may need special management to prevent their being placed on State or Federal threatened and endangered species lists.
Haul-Out—an area of large, smooth, exposed rocks used by seals and sea lions for resting and pupping.

Affected Environment

Threatened or Endangered Species

Federally listed threatened and endangered species are those plant and animal species formally listed by the U.S. Fish and Wildlife Service (USF&WS) or the National Marine Fisheries Service (NMFS), under the authority of the Endangered Species Act (ESA) of 1973, as amended. Species of concern are those being considered for listing as threatened or endangered by the USF&WS and NMFS. What are now being called species of concern were previously referred to as candidate species. The State of Alaska has an Endangered Species Law which authorizes the commissioner of the Alaska Department of Fish and Game (ADF&G) to list Alaska endangered species. The Regional Forester of the Forest Service can also designate species as "Sensitive." Sensitive species are those plants and animal species for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density, or significant current or predicted downward trends in habitat capability that would reduce a species' extinct distribution.

Fish

No threatened, endangered, candidate, or sensitive fish species are known to occur in the Chasina Project Area.

Plants

The policy of the Tongass National Forest is to "manage plants in order to maintain viable populations and to avoid actions that may cause a plant to become listed as threatened or endangered" (TLMP 1991a). Plants of concern are listed by the USF&WS as endangered or threatened under ESA of 1973, or species are identified as sensitive by the Regional Forester. Under the ESA of 1973, an endangered species is defined as one that is in danger of extinction throughout all or a significant portion of its range. A threatened species is defined as one that is likely to become endangered in the foreseeable future throughout all or a significant portion

of its range. Currently, no plant species native to Southeast Alaska are Federally listed as endangered or threatened. However, two species are currently considered species of concern. These species have evidence supporting formal listing as threatened or endangered but adequate information is not yet available on biological vulnerability or threats to justify final listing.

No plant species known to occur in the project area have been determined threatened or endangered. The two species of plants which are listed as species of concern with USF&WS have the potential to be found within the project area. The Forest Service in Region 10 has developed a list of 22 sensitive plants. A species on the Forest Service sensitive plant list was discovered during botanical surveys of the project area.

Wildlife

Two federally endangered wildlife species, the humpback whale (*Megaptera novaeangliae*), and Eskimo curlew (*Numenius borealis*), potentially migrate through the area, and three Federally threatened species, the Steller sea lion *(Eumetopias jubatus*), Aleutian Canada goose (*Branta canadensis leucopareia*), and American peregrine falcon (*Falco peregrinus anatum*) potentially migrate through or occur in the project area.

Humpback Whale

Humpback whales are found in coastal areas or near oceanic islands and appear to have a preference for near shore waters, especially the highly productive fiords of Southeast Alaska and Prince William Sound (Calkins 1986). The population of humpback whales are more numerous in Southeast Alaska than any other endangered whale and have been observed in every month of the year. The local distribution of humpbacks (listed by NMFS as Endangered) in Southeast Alaska appears to be correlated with the density and seasonal availability of prey, particularly herring *(Clupea harengus)* and euphausiids (shrimp-like crustaceans). A total of 13 fish species and 57 invertebrate species have been identified as potential prey of the humpback whale in Southeast Alaska (Wing and Krieger 1982). Important feeding areas for humpback whales in Southeast Alaska include Cape Fairweather, Lynn Canal, Sumner Strait, Dixon Entrance, the west coast of Prince of Wales Island, and offshore banks such as the Fairweather Grounds; none of which are within the project area. Because the humpback whale occupies near shore waters, it is especially vulnerable to environmental degradation and human disturbances associated with off-shore petroleum exploration and production, ocean dumping, toxic chemical pollution, coastal logging, mining and manufacturing, fishing, resort development, and pleasure boat and cruise ship traffic (Johnson and Wolman 1984). Such activities may disrupt whale feeding or result in damage to important habitat areas (Johnson and Wolman 1984). Critical habitat has not been designated for humpback whales; however, summer and fall concentrations of humpback whales have been observed in Southeast Alaska at Fredrick Sound, Salisbury Sound, Stephens Passage, and Glacier Bay (Baker et al. 1985, Calkins 1986). Humpbacks may occur throughout Southeast Alaska, including the waters around the project area.

Eskimo Curlew

Eskimo curlews once ranged from arctic North America to southern South America, migrating seasonally by way of the Atlantic and Central flyways (Gollop 1988). The species formerly occupied western and northern Alaska, but is now considered an accidental in Alaska (Armstrong 1991) and one of the rarest birds in North America (Gollop 1988). Eskimo curlews migrate along the Alaska interior and any occurrences along coastal regions are highly

unlikely (Armstrong 1991). This species has not been sighted in Alaska since 1986 (Armstrong 1988).

Steller Sea Lion

The Steller sea lion (listed by NMFS as Threatened) ranges from Hokkaido, Japan, through the Kuril Islands and Okhotsk Sea, Aleutian Islands and central Bering Sea, Gulf of Alaska, Southeast Alaska, and south to central California. Currently, information on Steller sea lion population trends in Southeast Alaska is limited. However, available information suggests that Steller sea lion populations are stable or slightly decreasing in Southeast Alaska. The most significant factors affecting Steller sea lion populations include: (1) reductions in availability of food; (2) commercial harvest of pups; (3) subsistence harvest of sea lions; (4) harvest for public display and scientific research purposes; (5) predation by sharks, killer whales (*Orcinus orca*), and brown bears (*Ursus arctos*); (6) disease; (7) inadequate regulatory mechanisms such as quotas on incidental harvest during commercial fishing operations; and (8) other natural or human factors such as illegal shooting of adult sea lions at rookeries, haul-out sites, and in the water near boats (TLMP RSDEIS 1996a). None of these factors are regulated by or are within the jurisdiction of the Forest Service, and critical habitat for Steller sea lions has not been designated. A sea lion haul-out has been located by NMFS on the southern point of Grindall Island just south of Kasaan Peninsula at Baker Point (letter from S. Pennoyer, National Marine Fisheries Service, Anchorage, Alaska, February 6, 1992). The nearest log transfer facility (LTF) associated with the project occurs in Lancaster Cove, approximately 15 miles south of this haul-out. The nearest sea lion rookery occurs over 50 miles southwest of the project area boundary at Forrester Island (Loughlin et al. 1984). There are no known Steller sea lion haul-out areas identified in the project area.

Aleutian Canada Goose

The Aleutian Canada goose nests on Buldir and Chagulak Islands in the Aleutian Archipelago, and winters primarily in the San Joaquin Valley of California (Amaral 1985). The species sometimes stops along the Oregon coast and occasionally is reported along the Washington coast while on the way to wintering grounds in California (Amaral 1985). Aleutian Canada geese are believed to have historically wintered from British Columbia to California (Amaral 1985). Although there are no records of Aleutian Canada geese on Prince of Wales Island, the area is within their migratory route (personal communication, J.Lindell, Endangered Species Coordinator, USF&WS, Anchorage, Alaska, September 18, 1992). Any migrating geese stopping over on Prince of Wales Island would likely be found resting in the central wetland areas.

American Peregrine Falcon

The endangered American peregrine falcon (*Falco peregrinus anatum*) may migrate through the Chasina Project Area, however, it is primarily associated with the boral forest region of interior Alaska (USF&WS 1982, Craig 1986). Population declines in peregrine falcons occurred after World War II and were due primarily to reductions in breeding habitat and contamination by organochloride pesticides (USF&WS 1982). However, this subspecies has recently experienced increases in population and reproduction, and the U.S. Fish and Wildlife Service has recently (October 5,1994) down-listed the species from endangered to threatened. Actual migration routes and foraging areas of peregrine falcons in Southeast Alaska have not been identified and specific use of the project area is unknown. However, the project area is within the migratory pathway of the American peregrine falcon (Anderson et al. 1988). However, most coastal migrants are apparently the non-listed Peale's peregrine falcon (*F.p. pealei*) subspecies, and most American peregrines migrate inland. Peregrines potentially

migrating through the area probably forage on prey species that they are known to use elsewhere, including shorebirds, waterfowl, and songbirds (Anderson et al. 1980). Marshes and riparian areas are particularly important peregrine feeding areas, since they attract and concentrate prey species (Craig 1986).

Species of Concern and Sensitive Species

Federally listed species of concern or sensitive species of fish and wildlife occurring in Southeast Alaska include Alexander Archipelago wolf (*Canis lupus ligoni*), marbled murrelet (*Brachyramphus marmoratus*), Kittlitz's murrelet (*Brachyramphus brevirostris*), Queen Charlotte goshawk (*Accipiter gentilis laingi*), Arctic peregrine falcon (*Falco peregrinus tundris*), harlequin duck (*Histrionicus histrionicus*), olive-sided flycatcher (*Contopus borealis*), spotted frog (*Rana pretiosa*), and bull trout (*Salvelinus confluentus*).

There are two plant species which are classified by the USF&WS as species of concern, thickglum reedgrass *(Calamagrostis crassiglumis)* and goose-grass sedge *(Carex lenticularis var. dolia*), which are known or suspected to occur in the Ketchikan Area of the Tongass National Forest. The thickglum reedgrass is currently listed as a species of concern, however, the Fish and Wildlife Service has recently requested that the species not be considered at this time. This is due to a recently published taxonomic work which "lumped" this taxa with the more common *C. Stricta*. Of the 22 Forest Service listed sensitive plant species, only 11 are known or suspected to occur in the Ketchikan Area of the Tongass National Forest ; Goose-grass sedge *(Carex lenticularis* var. *dolia*), edible thistle (*Cirsium edule*), Davy mannagrass *(Glyceria leptostachya*), Wright filmy fern (*Hymenophyllum wrightii*), Truncate quillwort (*Ioestes truncata*), Calder lovage (*Ligustucum calderi*), Choris bog orchid (*Plantanthera chorisana*), bog orchid (*Plantanthera gracilis*), loose-flowered bluegrass (*Poa laxiflora*) , straight-beak buttercup (*Ranunculus orthorhynch*s var. *alaschensis*), and Queen Charlotte butterweed (*Senecio moresbiensis).*

The Trumpeter swan (*Cygnus buccinator*), osprey (*Pandion haliaetus*), and Peale's peregrine falcon (*Falco peregrinus pealei*) are on the Forest Service sensitive species list. The Queen Charlotte goshawk (*Accipiter gentilis laing*), is also on this list. These species may or do occur in the project area. The Franklins spruce grouse (*Dendraragapus canadensis franlinii*) is addressed in this section even though it is not a threatened, endangered, or sensitive species or a species of concern, but because of the concern expressed by the Alaska Department of Fish and Game.

Alexander Archipelago Wolf

The Alexander Archipelago wolf is a small subspecies of the gray wolf (Goldman 1937, Pederson 1982).

Wolves are wide ranging, opportunistic predators that do not exhibit a preference for specific habitats or habitat characteristics (Paradiso and Nowak 1982). The presence of wolves in an area appears to be dictated by the availability of habitat for prey species, rather than land form, climate, or vegetation. The primary food of most Southeast Alaskan wolves is deer (Wood 1990, Person 1993). Beaver, and spawning salmon may also be utilized as prey when available (Wood 1990). Availability of suitable denning habitat is of secondary importance to wolves. In forested areas, dens are usually located on elevated knolls within 1,600 feet of water (Carbyn 1987). Dens located on Prince of Wales Island have been in old-growth stands within 100 meters of freshwater (Person and Ingle 1995).

The construction of road systems and timber harvest on Prince of Wales Island alters the habitat of wolves and their prey. The primary threat of high road densities comes from the accessibility they allow humans who deliberately, accidentally, or incidentally kill wolves by shooting, snaring, or trapping" (Suring et al. 1992). There have been many studies which have shown that wolf abundance may be correlated with road density (Theil 1985, Jensen et al. 1986, Mech et al. 1988, Fuller 1989). In one study, wolves generally were not present where the density of roads used by humans exceeds 0.93 mi/sq mi (0.58 km/sq km) (Mech et al. 1988). However, other work has suggested that wolves could exist in areas with higher road densities if these areas are adjacent to roadless areas (Mech et al. 1988). Suring et al. (1992) recommends that road densities be maintained below this level within each Wildlife Analysis Area (WAA). The TLMP RSDEIS (1996a) recommends that sufficient habitat should be maintained to support at least 13 deer per square mile in areas where deer are the primary prey species. Based on the Sitka Black-tailed Deer Habitat Capability Model, the project area supports approximately 25 deer per square mile with patch-seize effects taken into consideration.

The USF&WS was petitioned to list the Alexander Archipeligo wolf as threatened under the Endangered Species Act. The petition was based on several factors: present and threatened destruction, modification, and curtailment of habitat from the reduction and long-term degradation of habitat for Sitka black-tailed deer by clearcut logging; inadequate regulation of road access leading to increased shooting, and trapping of wolves; and other factors including inbreeding with insular populations that may reduce genetic fitness, adaptability, and long-term viability (USDA Fish and Wildlife Service 1994). The USF&WS undertook a status review of the Alexander Archipeligo wolf and found that listing was not warranted at this time (USDA Fish and Wildlife Service 1995). The wolf is considered a species of concern.

A study is currently underway on north-central Prince of Wales and adjacent islands to determine distribution and abundance, home range, movements, habitat use, and the feeding ecology of the wolf. Information to date indicates that within Game Management Unit 2 (GMU-2), only Prince of Wales Island is sufficiently large to maintain a permanent wolf population in the absence of immigration from some other source. An average pack home range on north Prince of Wales is 264 square kilometers. This appears to be larger than home ranges reported for wolf packs in other studies where the primary prey is deer. An analysis of habitat use verses availability for three packs, based on radio locations, showed that the wolves use high volume old growth in proportion to its availability; two packs used low volume stands more than expected and one pack used noncommercial habitat more than excepted; all three packs used second-growth habitat significantly less than excepted (Person and Ingle 1995).

Based on application of the Tongass Habitat Capability Model for the gray wolf, habitat capability declined about 14 percent in the project area between pre-logging and existing conditions. This decline is directly related to a reduction in deer habitat capability associated with conversion of old-growth forest to young second growth. The habitat capability model for wolves is tied directly to the habitat capability model for Sitka black-tailed deer. This is based on the assumption that wolves will first select large ungulates as prey and will utilize beaver and other prey species as maintenance prey when deer are not as plentiful (Suring et al.1992). Accompanying this decline has been an increase in road density associated with logging activities. Road density is currently approximately 1.6 mi./sq. mi. across the project area when including Native and State ownership, and .32 mi./sq. mi. when only considering National Forest Lands.

Marbled Murrelet

The marbled murrelet was recently listed as threatened in California, Oregon, and Washington. Marbled murrelets, however are still abundant in Alaska where they are currently considered as a species of concern. Recent estimates by the USF&WS (1995) place Southeast Alaska populations of marbled murrelets at between 267,000 and 600,000.

The marbled murrelet is a robin-sized seabird belonging to the family Alcidae. This species is found throughout the North Pacific; the North American subspecies ranges from Alaska's Aleutian Islands to central and occasionally southern California. The marbled murrelet feeds in near-shore ocean feeding areas, inland saltwaters, and occasionally inland freshwater lakes. The bird feeds below the water's surface on small fish and invertebrates.

Nests sites have been located in mature and old-growth forests comprised of Douglas-fir (*Pseudotsuga menziesii*), coast redwood (*Sequoia sempervirens*), western red cedar (*Thuja plicata*), mountain hemlock (*Tsuga mertensiana*), Sitka spruce *(Picea sitchensis*), and western hemlock (*Tsuga heterophylla*), (Ralph and Nelson 1992). One nest has been located on south Prince Wales Island. In addition, during the field season in 1995 eggshell fragments were found in two locations in the Chasina Project Area.

The limited data on marbled murrelet nesting behavior is inconclusive regarding nest-site fidelity. Marshall (1988) observed a murrelet nest in California in a tree that appeared to be used over a period of several years. However, Ralph and Nelson (1992) indicate that murrelets (no location given) are not known to reuse nest trees. Based on high nest-site fidelity observed in other alcid species, it is highly probable that marbled murrelets at least have strong fidelity to certain forest stands that have been used for nesting (personal communication, T. Hamer, Hamer Environmental, Sedro Woolley, Washington, September 24, 1992). This is supported by recent work on murrelet nesting behavior in California where murrelets have been observed repeatedly nesting in loose colonies in different portions of the same forest stand (Marshall 1988, Ralph and Nelson 1992).

Three primary factors that may limit marbled murrelet reproduction or survival include removal of old-growth habitat, mortality from gill-net fisheries, and oil pollution (Marshall 1988). Information on murrelet nesting mortality indicates that this species is highly susceptible to nest-site predation from avian predators that are associated with forest edges and fragmentation. Consequently, fragmentation of contiguous old-growth areas by logging and associated predator concentrations along forest edges have the potential to adversely affect murrelet nesting success within an area (personal communication, T. Hamer, Hamer Environmental, Sedro Woolley, Washington, September 25, 1992).

The marbled murrelet is currently listed as a species of concern in Alaska. The U.S. Fish and Wildlife Service has listed the marbled murrelet as threatened in Washington, Oregon, and northern California. In the Pacific Northwest and Southeast Alaska, the bird normally nests in trees in old-growth forests, however, a ground nesting marbled murrelet has been discovered on Prince of Wales Island (Thorne Bay Ranger District 1993). Population centers for marbled murrelets appear to be restricted to mature or old-growth forests. Actual nest sites are frequently on large, flat, often moss covered limbs high above the forest floor. Common use of moss for the nest substrate may be significant because lush moss does not appear on the conifers of the northwest until the forest is 150 or more years old (Marshall 1988). Three nest trees have been found in Southeast Alaska, two on Prince of Wales Island. Although nest data suggests that murrelets in Southeast Alaska may use mature or old-growth forests exclusively

(Nelson and Hamer 1992), use of second-growth forest apparently has not been thoroughly researched in Alaska.

In the summer of 1995 murrelets were seen on the water near the project area. During field reconnaissance in 1995, two murrelet eggshells were found. One was on the southwest corner of Unit 679-409. This unit is located just east of Lancaster Cove. The eggshell was found at the base of a western hemlock tree. There was a mistletoe and moss platform directly above the eggshell about 100 feet up in the tree. The stand of timber in which the eggshell was found is predominantly western hemlock with a few large Sitka spruce trees scattered throughout. The second one was within Unit 681-373, at the base of a large western red cedar. It was located in the southwest corner of the unit which is located in the Port Johnson area. The timber in the surrounding area was predominately a mixed conifer and salal plant association.

Marbled murrelet at-sea surveys were done in the project area in the summer of 1992. One transect each was run in Lancaster Cove, Dora Bay and Kitkun Bay. In Lancaster Cove 255 marbled murrelets were seen. Dora Bay and Kitkun Bay had 80 and 31 respectively.

Marbled murrelet habitat requirements are not well established for Southeast Alaska, and there is a need for research on both nesting and foraging habitat requirements as well as mortality factors such as oil spills, fishing nets, and predation. However, the available information indicates that habitat for regional marbled murrelet populations is probably adequate.

Interim Standards and Guidelines for marbled murrelets call for leaving a minimum 30-acre windfirm buffer around all nests discovered, so that the nesting site can be studied in order to gain a better understanding of the nesting habitat requirements of marbled murrelets in Southeast Alaska.

Kittlitz's Murrelet

Kittlitz's murrelet is a small seabird belonging to the Alcidae family. Information is limited on the natural history of this species. Kittlitz's murrelet is distributed near glacial waters from Point Barrow south to at least Glacier Bay, most commonly from Cape Prince of Wales south to Glacier Bay from spring through fall (Robbins et al. 1983, Peterson 1990). Winters are spent feeding in offshore pelagic waters. Kittlitz's murrelet forages on crustaceans in inshore marine waters during the breeding and nesting season in Alaska. Nests are generally located inland on the ground above the timberline in coastal mountains at the base of north-facing slopes. One egg per clutch is laid on the bare ground amid lichen-covered rocks. Kittlitz's murrelet does not occur as far south as the Chasina Project Area.

Northern Goshawk/ Queen Charlotte Goshawk

The goshawk is a raven-sized raptor associated with forests having tall trees and dense canopies. These features allow goshawks to hunt beneath the tree canopy, and to capture prey before the prey escapes into the trees or shrub layer. The dense canopy in tall trees fosters a more abundant prey species population and provides a microclimate suitable for nesting. Goshawks forage over home ranges that are typically 6,000 to 8,000 acres, though home range may be twice that size in fragmented forests (C. Crocker-Bedford 1991). The Queen Charlotte goshawk is one of three federally recognized subspecies of the northern goshawk (Johnsgard 1990). It is endemic to Southeast Alaska and coastal British Columbia and is probably a resident throughout its range (Taverner 1940).

The northern goshawks prey on both birds and mammals. The prey of the Queen Charlotte goshawk include the northwestern crow (*Corvus caurinius*), Steller's jay (*Cyanocitta stelleri),* varied thrush, (*Ixoreus naevius*), and spruce grouse *(Dendragapus canadensis*).

The primary breeding habitats of the northern goshawk are dense, older-age stands of deciduous, coniferous, or mixed forests. Large trees provide important nesting and perching sites, and the closed canopy provide a favorable microclimate for nesting. Closed canopies may also inhibit the growth of small trees and shrubs which could interfere with goshawk flight and prey capture, and may reduce competition and predation by raptors more closely associated with forest edges (Crocker-Bedford 1992). Important prey species may also be more abundant in old-growth forests.

There have been several confirmed goshawk sightings in Southeast Alaska, however none have occurred within the project area. There has been one reported but unconfirmed sighting within the project area. This occurred at the mouth of Cannery Creek in the South Arm portion of the Chasina Project Area. Surveys were conducted in this area in 1995, but no goshawks were seen or heard. An unidentified hawk species was seen in this area during the 1995 field season and this will be followed up with more surveys in the area next year.

During the 1995 field season 326 stations were surveyed in 68 units within the project area, for a total of 8,150 acres. There were no detections during the survey protocol time limits, however, an unidentified hawk was heard in the same area on two consecutive days and seen on the third day in late October within the project area. There will be follow-up surveys done in this area in 1996. This a different sighting than the one reported in Cannery Creek.

The northern goshawk has been listed as a species of concern for all of its range, including the Queen Charlotte subspecies which is present in Southeast Alaska. A status review was completed and a decision was made that listing the species as Threatened or Endangered at this time is not warranted (U.S. Fish and Wildlife Service News Release 1995).

The current guidelines for Northern Goshawk Management Areas consist of two components:

- Nest Stand—Maintain an area of at least 25 acres around the confirmed nest tree (and probable nest tree if identified) and attempt to include prey handling areas, perches, and roosts. Vegetative structure objectives generally include a multi-layered, closed (over 60 percent) forest canopy and a relatively open understory with large trees (usually 20+ inches dbh) and low ground vegetation. These structural characteristics generally equate to Volume Class 5 and higher in the timber resource inventory.

  Management: No vegetative manipulation or new road construction is permitted. Existing roads may be maintained. Permit no continuous disturbance, likely to result in nest abandonment within the surrounding 600 feet, from March 15 to August 15. Activity restrictions are removed for active nests that become inactive or unsuccessful.

- Nesting Habitat—Maintain an area of not less than 75 acres surrounding the Nest Stand (total management area of 100 acres). Include inactive nest stands, hiding cover, and foraging opportunities for young goshawks. Vegetative structure is similar to the Nest Stand but may include some intermediate canopy (e.g., Volume Class 4).

Management: No commercial timber harvest is permitted within the Nesting Habitat. New road construction is permitted (outside the Nest Stand) if no other reasonable roading alternatives outside the mapped Nesting Habitat exist. Other management activities which maintain the integrity of the forest stand structure are consistent with the objectives for this area.

In compliance with the 1995 Recession Bill, Section 502, and the 1996 Appropriations Bill, interim nest protection zones for active goshawk nests will not exceed 300 acres. Due to the controversial and ever changing nature of goshawk guidelines, current guidelines at the time of project implementation will be utilized.

Arctic Peregrine Falcon

The Arctic peregrine falcon is primarily associated with the area north of the Brooks Range and Seward Peninsula; it is highly migratory, wintering as far south as Argentina (Ambrose et al. 1988). It occurs in Southeast Alaska only during migration periods. Population numbers have increased three-fold in Alaska (ADF&G letter Feb. 6,1987; Ambrose et al. 1988; minutes of Interagency Wildlife Technical Committee Meeting of March 20, 1991). Effective November 4, 1994 the USF&WS removed the species from the threatened list. It is now considered a species of concern.

Harlequin Duck

The harlequin duck's range is divided into two distinct regions: eastern and western. The western range includes northeast Siberia west to the Lena River, east to the Kamchatka Peninsula and the Commander Islands, and north to the Arctic Circle, then across the Bering Sea to the Aleutian Islands, much of the interior Alaska, south to northwest Wyoming, and central California (Bellrose 1980). In Alaska, the harlequin duck as been reported as a fairly common year-round resident, and at one season or another, has been recorded over much of the State except the Arctic coast (Gabrielson and Lincoln 1959).

Available evidence indicates that the species breeds locally over much of southern Alaska, probably the Aleutians, and north to Anaktuvuk Pass. Ornithologists who have worked during the spring and summer months in the Alexander Archipelago and other parts of Southeast Alaska have commented upon the numbers of these ducks, frequently summarizing their observations by stating that they were common or abundant (Gabrielson and Lincoln 1959).

Harlequins nest along inland fast-moving rivers and streams, usually within 6 feet (but up to 60 feet) of water (DeGraaf et al. 1991). The nest site generally has shelter overhead: a recess in a streambank or among rocks, or under shrubs, trees, or stranded debris. Occasionally the nest is in an open area or even on a stream bar, but under shrubbery or other low vegetation. During the winter the harlequin duck is common to abundant in the coastal waters of Southeast Alaska, Prince William Sound, Cook Inlet, the bays of the Alaska Peninsula, the Aleutians, and the Pribilofs (Gabrielson and Lincoln 1959). Preferred winter habitat is reported to be areas along surf-pounded rocky coasts, rather than sheltered bays and fiords, where water is one to two fathoms deep and turbulent, and where bottom fauna abounds (Palmer 1975). Harlequins feed on molluscs, crustaceans, insects, fish, and echinoderms (Bellrose 1980).

There is no information available on the breeding biology of the harlequin duck in the project area. Five harlequin ducks were seen in South Arm on October 11, 1995.

Olive-sided Flycatcher

The olive-sided flycatcher breeds in wooded regions from central Alaska east to Newfoundland and south to northern Baja California and central Arizona in the west, central Minnesota and northern Michigan in the central states, and North Carolina and Tennessee in the east. The species winters in South America.

It inhabits open coniferous forests and forest edges along lakes, streams, and muskegs (Bent 1942). Godfrey (1979) described the habitat of the species as "burnt lands with standing dead trees, bogs. Lakeshore with water-killed trees, lumbered areas, and other clearings in woodlands." DellaSala et al. (1994) noted that the species was often observed using habitats associated with lakes and muskegs during a breeding bird study on central Prince of Wales Island.

Spotted Frog

This species is believed to range from south of the Taku River to other transboundary rivers and some islands of Southeast Alaska and British Columbia (Holmberg 1992). Distribution of spotted frogs in Southeast Alaska is confined to coastal forests where it breeds in association with permanent bodies of water, including grassy margins of lakes, rivers, and streams (Hodge 1976, Broderson 1982, Nussbaum et al. 1983). Although the species is primarily aquatic (Hodge 1976, Broderson 1982, Nussbaum et al. 1983), spotted frogs have been reported moving overland in spring and summer (Behler and King 1979).

Declines in the distribution and abundance of spotted frogs have been noted in western Canada and the Pacific Northwest (McAllister and Leonard 1991), and these declines are apparently related to the destruction of terrestrial and aquatic habitats and predation by bull frogs *(Rana catesbeiana)* (Nussbaum et al. 1983, McAllister and Leonard 1991b). Spotted frogs have been documented in the Stikine River basin (Waters 1992), and most recently have been observed by USF&WS in the Unuk River. Although its status in the study area is unknown, literature records indicate that it may occur on or near Prince of Wales Island (Hodge 1976). Several spotted frog surveys have been conducted on Prince of Wales Island as well as some of the outside islands, but no spotted frogs were found, only numerous rough-skinned newts *(Taricha granulosa)* and western toads *(Bufo boreas)*.

Bull Trout

Although the range of bull trout in the contiguous United States has become greatly restricted in recent times (Goetz as cited in Hass and McPhail 1991), it still exists as far south as the Oregon-California border, north through Canada, and in the Yukon River system in Alaska (Hass and McPhail 1991). Bull trout are largely confined to interior regions throughout their distribution, only reaching the Pacific coast in the Puget Sound area of Washington and in the Fraser River drainage in British Columbia (Hass and McPhail 1991). Since bull trout have only been observed in the drainages of major interior river systems, it is not likely that bull trout occur in the streams of the Chasina Project Area.

Thickglum Reedgrass

This grass occurs in marshy wet areas, but not in muskegs. It is not known to occur on Prince of Wales Island.

Goose-Grass Sedge

This sedge is known to occur in the coastal mountains of Alaska and British Columbia and the Rocky Mountains from Jasper, B.C., south to Glacier National Park, Montana. Its range in

Alaska is limited to the alpine of coastal Southcentral and Southeast Alaska and the Aleutian Islands. There are nine documented occurrences in Alaska (Forest Service 1994), in Southeast, at the Mendenhall Glacier, Bailey Bay on Cleveland Peninsula, and the Chickamin Glacier. This species is not known to be found within the project area. Its habitat is wet alpine meadows and bare edges of snowbeds, but not known to occur in forested areas.

Trumpeter Swan

Trumpeter swans winter in specific ice-free areas throughout Southeast Alaska (letter from J.N. West, Forest Service, Ketchikan, Alaska, to C. Crocker-Bedford, Forest Service, Ketchikan, Alaska, July 2, 1991). However, swans appear to show extreme fidelity to specific wintering areas (Gale 1989). Although information on wintering habitats and populations of trumpeter swans in Southeast Alaska is limited, in general swans winter along estuaries, intertidal lakes, streams, and muskegs (letter from C. Crocker-Bedford, Forest Service, Ketchikan, Alaska, July 2,1991). Wintering locations include open areas with adjoining grassflats with level terrain that allow swans to rest, feed, and fly without restricting visibility or movement. Swans wintering on Prince of Wales Island tend to use areas with good winter sun exposure and protection from prevailing southeasterly winds (letter from C. Crocker-Bedford, Forest Service, Ketchikan, Alaska, July 2, 1991). Trumpeter swans breeding in Alaska spend the winter along the Pacific Coast from the Alaska Peninsula to the mouth of the Columbia River, where they take advantage of open waters of saltwater estuaries and freshwater lakes and rivers.

Breeding habitat includes wetland areas with reeds, sedges, or similar emergent vegetation, primarily on fresh water but occasionally in brackish situations. In Alaska, horsetails and sedges are frequently used for nests (Bellrose 1980). The nests are placed in water 1-3 feet deep, and the same nest site may be used for several years (Bellrose 1980).

Trumpeter swans are present in the project area primarily during the fall and early spring migration periods and during winter. In Southeast Alaska, breeding is restricted to the Chilkat River Valley. There are no records of trumpeter swans nesting in the project area, however, swans are known to winter on the fresh water lakes of Prince of Wales Island. Winter surveys have been conducted on the project area and three swans were sighted in Dora Bay in February 1995.

Osprey

Osprey occur in low numbers in Southeast Alaska during the spring/summer nesting period from late April through August. They are believed to overwinter in Mexico and Central America. Osprey have been observed on Prince of Wales Island in the Old Franks Creek drainage. Historically, the Southeast Alaska population has remained stable but low. It is unknown why osprey occur in relatively low numbers in this region, but available nest sites and foraging areas do not appear to be limiting factors.

Peale's Peregrine Falcon

The Peale's subspecies of the peregrine falcon *(F. p. pealei)* nests on the outer islands west of the project area (Schempf 1981,1982). This subspecies is not listed as endangered or threatened, but is covered by a provision "similarity of appearance" which broadens the scope of protection for all peregrine falcons. The nest distribution of this subspecies is closely associated with large seabird colonies, and seabirds are believed to be major prey of the falcon.

Actual migration routes and foraging areas of the peregrine falcon in Southeast Alaska have not been identified and specific use of the project area is unknown. However, the project area is within the migratory pathway of the American peregrine falcons (Anderson et al. 1988), although most coastal migrants are apparently the non-listed Peale's subspecies and most American peregrines migrate inland. Peregrines potentially migrate through the area and probably forage on prey species that they are known to use elsewhere, including shorebirds, waterfowl, and songbirds (Anderson et al. 1988). Marshes and riparian areas are particularly important peregrine feeding areas, since they attract and concentrate prey species (Craig 1986).

Prince of Wales Flying Squirrel

The Prince of Wales flying squirrel (*Glaucomys sabrinus griseifrons*) is one of 25 subspecies of northern flying squirrels that occur in forested regions throughout most of North America (Suring 1992). It is found only on Prince of Wales Island. Although little is known about its population status or distribution, flying squirrels are "frequently" seen on Prince of Wales Island by trappers (Alaska Natural Heritage Program 1992). However there are no recent observations in the project area.

The natural history of flying squirrels in Southeast Alaska is poorly understood. Although several studies have been conducted in eastern North America, the Pacific Northwest, and interior Alaska, it may not be possible to accurately infer interrelationships between flying squirrels and their habitat on Prince of Wales Island based on studies conducted in other geographic areas. Never less, information from such studies may facilitate the identification of habitat characteristics considered important to the Prince of Wales flying squirrel (Suring 1992).

The association of northern flying squirrels with old-growth forests throughout their range is well documented (Suring 1992). The attributes of old-growth forests that have been identified as important to flying squirrels are: (1) availability of denning habitat (natural tree cavities and woodpecker excavations are used to a large extent as den sites); (2) foraging habitat (studies indicate that fungi and lichens, which are commonly available only in old-growth forests, are major food sources for northern flying squirrels); and (3) protection from predators. It has been suggested that flying squirrels prefer forests characterized by well defined shrub understory that provides protection from predators while squirrels are foraging (Suring 1992).

Franklin's Spruce Grouse

The Franklin's spruce grouse *(Dendragapus canaderis franklinii)* is another species of interest in Southeast Alaska, although it is not listed as threatened, endangered, sensitive, or a species of concern. This species occurs in low densities on and near Prince of Wales Island (Gustafson 1994). A nest was observed near the head of Twelvemile Arm in 1903 (Osgood 1905). An observation of a female with chicks was made in the same area in 1992 (Gustafson 1994). The species uses old-growth forests, especially those containing spruce, young second growth prior to canopy closure, as well as other habitats.

Goose-grass Sedge

This sedge is known to occur in the coastal mountains of Alaska and British Columbia and the Rocky Mountains from Jasper B.C., south to Glacier National Park, Montana. Its range in Alaska is limited to the alpine of coastal Southcentral and Southeast Alaska and the Aleutian Islands. There are nine documented occurrences in Alaska (Forest Service 1994); in

Southeast, at Mendenhall Glacier, Bailey Bay on Cleveland Peninsula, and the Chickamin Glacier. This species is not known to occur in the project area. Its habitat is wet alpine meadows and bare edges of snowbeds. It is not known to occur in forested areas, so is not expected to be impacted by this project.

Edible Thistle

This regionally endemic thistle species is distributed primarily along coastal Oregon, Washington, and British Columbia, and barely reaches southern most Southeast Alaska. The only documented occurrence is near Hyder in interior Southeast Alaska near the border of Canada (Forest Service 1994). It is unknown whether this species occurs in the project area. Its habitat in Alaska is characterized as wet meadows and open woods along glacial streams so it is not expected to be impacted by this project.

Davy Mannagrass

This grass species is distributed from Southeast Alaska to central California. Its distribution in Alaska is limited to central and southern Southeast Alaska. It is known to occur in only two documented locations; near Wrangell, Alaska and on Prince of Wales Island. However, it is easily overlooked and likely to be more widespread in Southeast (Forest Service 1994). It occurs in wet lowland habitats including swamps, and lake and stream margins. Due to the protection that these areas already receive it is unlikely that this species will be impacted by the Chasina Project.

Wright Filmy Fern

This fern species occurs in coastal areas of Southeast Alaska and British Columbia. Three sightings have been documented in Alaska and are limited to Biorka and Mitkof Islands (Forest Service 1994). It is unknown if the species occurs in the project area. This species appears to prefer humid shaded boulders, cliffs, tree trunks, and damp woods in the wettest maritime regions. In Alaska, it has been found in small populations on the base of trees and rock outcrops in damp woods.

Truncate Quillwort

This rooted aquatic species is known from a few widely isolated populations on Vancouver Island and southcentral Alaska on the Copper River Delta (Forest Service 1994). It is unknown if this species occurs in the project area. Truncate quillwort occurs in shallow water of lakes and streams. Since this species is a rooted aquatic it will not likely be affected by this project.

Calder Lovage

This plant species occurs in British Columbia and Southcentral and Southeast Alaska. Documented occurrences in Alaska are limited to two disparate areas on Kodiak Island and Dall Island (just west of Prince of Wales Island) in Pleistocene refugia on limestone substrate (Forest Service 1994). It is unknown if this species occurs in the project area. Calder lovage occurs on rocky cliffs, open boggy or rocky slopes, and edges of coniferous forests. In Alaska it is known from alpine meadow habitats and edges of subalpine mixed coniferous forest.

Choris Bog Orchid

In Alaska, this bog orchid species is limited to the Aleutian Islands and southern coastal areas (Forest Service 1994). Eight occurrences have been documented in Alaska, primarily from the Aleutians. Elsewhere in Alaska, reported sightings are disjunct and infrequent and are

limited to areas near Juneau (primarily Chichagof Island) and Prince William Sound. Recent botanical surveys have revealed specimens of this species within the Chasina Project Area.

Bog Orchid

This species of bog orchid is limited to a small geographic range in southern most Southeast Alaska and adjacent British Columbia (Forest Service 1994). Two documented sightings have been made in Alaska near Pearse Canal and on Dall Island. It is unknown if this species occurs in the project area. This plant occurs in wet open meadow habitat. It is undetermined whether the taxon of this species is distinct; if it is not, it may be more common than previously believed (Forest Service 1994).

Loose-flowered Bluegrass

The distribution of this grass species is scattered between Southeast Alaska and Oregon. Seven sightings have been documented in Southeast Alaska near Hoonah, Sandborn Canal at Port Houghton, and Admiralty Island (Forest Service 1994). It is not known if this species occurs in the project area. Loose-flowered bluegrass is associated with moist, open lowland woods and open-forest meadows.

Straight-beak Buttercup

This species of buttercup is distributed from coastal southern Southeast Alaska to adjacent British Columbia and Vancouver Island (Forest Service 1994). The closest documented occurrences to the project area include San Fernando Island, which is just west of Prince of Wales Island. It is unknown if the species occurs in the project area. It occurs in moist, open, lowland meadows and other moist open habitats.

Queen Charlotte Butterweed

This species of butterweed is limited to the Queen Charlotte Islands of British Columbia and to disjunct populations in southeastern Alaska and northwestern Vancouver Island (Forest Service 1994). Five occurrences have been documented in Alaska on Prince of Wales, Coronation, Baker and Dall Islands. It is not known if this species occurs in the project area. Queen Charlotte Butterweed occurs in shady wet areas and bogs of montage to alpine habitats, to open, rocky or boggy slopes, and in open, rocky heath or grass communities (Douglas 1982 in Forest Service 1994).

Effects of the Alternatives

Threatened or Endangered Wildlife Species

Proposed actions in each of the alternatives are not anticipated to adversely affect directly, indirectly, or cumulatively the Eskimo curlew, Kittlitz's murrelet, Aleutian Canada goose, American peregrine falcon, or the Arctic peregrine falcon. A draft biological assessment is included in Appendix D.

Humpback Whale

Two types of boat activity associated with LTFs, log raft towing and recreational boating by workers, may have an effect on whales. Log raft towing frequency would vary between camps, seasons, and years; a general average may be about once a week during the working season (U.S. Forest Service 1989-94 Operating Period for the KPC Long-term Contract).

The speed and direction of tugs and recreational boats may affect whale behavior; however, log raft towing routes are generally well established, and adverse effects from log raft towing have not been documented.

Recreational boating activity would vary between seasons and years. The effect of such recreational activity on whales would depend on factors such as size of the bay, depth of the water in the bay, number of boats, and individual behavior responses of the whales. There currently is not a quantifiable way to estimate these possible effects.

No direct or indirect effects on whales from implementation of forest management activities are anticipated. Forest-wide standards and guidelines have been developed to prevent and/or reduce indirect effects due to Forest Service permitted or approved activities. The following standards and guidelines have been developed for application on all Forest Service permitted or approved activities to provide for the protection and maintenance of whale habitats.

1. Avoid intentional aircraft flights below 500 feet above-ground level in the known vicinity of whales on Forest Service permitted or approved activities when weather ceilings permit.

2. Avoid intentional approach in a vessel of 100 feet or more in length to within 0.25 mile of whales on Forest Service permitted or approved activities when safe passage exists.

3. Avoid intentional approach in a vessel of less than 100 feet in length to within 100 yards of whales on Forest Service permitted or approved activities when safe passage exists.

Steller Sea Lion

No areas within the project area have been listed by NMFS as critical sea lion habitat.

Forest-wide standards and guidelines have been developed to prevent and/or reduce indirect effects of harassment or displacement of marine mammals due to Forest management activities. These guidelines will be followed.

Species of Concern

Alexander Archipelago Wolf

Implementing any of the Chasina Project action alternatives will result in a reduction in deer habitat capability. Wolf habitat capability is predicted to be reduced in proportion to the reduction in deer habitat capability.

Road density will also increase in the project area as a result of implementation of any of the action alternatives. Total road density would range from .5 mi./sq. mi. after implementation of Alternative 2, to 1.3 mi./sq. mi. after implementation of Alternative 6. However, the effect of increased road density would be substantially mitigated by access management and the fact that roads in the project area are not connected to any major human population centers.

Because of the reduction in deer habitat capability and the increase in road density associated with implementation of any one of the action alternatives, the Chasina Project may affect the Alexander Archipelago wolf. However, the effects of this project are expected to be less for Alternatives 2 and 4 which do not involve extensive roading into previously unroaded areas.

Marbled Murrelet

All action alternatives will harvest stands capable of providing nesting habitat (old-growth forests) for marbled murrelets. Table WIL-6 in the Wildlife section of this chapter shows that Alternatives 2, 3, 4, 5, and 6 harvest 5, 8, 12, 9, and 17 percent, respectively, of the commercial old-growth forest in the project area.

Based on current information, a reduction in available nesting habitat may occur; therefore, marbled murrelets may be affected. Any nests located during field reconnaissance or unit layout will be protected from timber harvest and blowdown with a minimum 30 acre buffer, so that the nesting site can be studied in order to gain a better understanding of the nesting habitat requirements of marbled murrelets.

Kittlitz's Murrelet

No observations have been made of this species in the Chasina Project Area and it does not appear that this species is dependent on old-growth forests for nesting habitat; therefore, no effects are anticipated for Kittlitz's murrelet.

Northern Goshawk/Queen Charlotte Goshawk

Goshawks are extremely difficult to locate, so it is possible that there could be a breeding territory in the Chasina Project Area. All action alternatives will harvest stands capable of providing nesting habitat (old-growth forests) for goshawks. Table WIL-6 in the Wildlife section of this chapter shows that Alternatives 2, 3, 4, 5, and 6 harvest 5, 8, 12, 9, and 17 percent, respectively, of the commercial forest in the project area; therefore, goshawks may be affected.

Any goshawk nests found during field reconnaissance or unit layout will be protected from harvest, following the current Forest Guidelines for Goshawk Management. As specified in Public Law 104-19, Sec 502(a), an interim Goshawk Habitat Conservation Area not to exceed 300 acres may be established around each active nest.

Harlequin Duck

Nesting habitat for the harlequin duck occurs along in-land rivers and streams. Riparian habitats along all rivers and streams in the project area will be managed according to Stream and Lake Protection management prescriptions. As a result, nesting habitat requirements are expected to be maintained.

Since winter habitat occurs in the marine environment, in areas of high surf and rocky beaches, no effect on harlequin ducks is anticipated with any of the alternatives of the Chasina Project.

Olive-sided Flycatcher

Since this species prefers open forest or forest edges, upland habitat value may be improved. Created openings will produce greater edge, and if reserve trees and snags are retained, flycatcher habitat could be improved. Therefore, this project may positively affect olive-sided flycatcher habitat for the better.

Spotted Frog

Riparian habitats along all lakes, rivers, and streams will managed according to the Stream and Lake Protection management prescription. With implementation of these measures, no

effect on the spotted frog is anticipated by the Chasina Project, even if it was found to occur within the project area.

Bull Trout

Due to the distribution patterns of this species, it is not expected to occur in the Chasina Project Area. Riparian habitats along all lakes and streams will be managed according to the Stream and Lake Protection management prescription. With the implementation of these measures, no effect on the bull trout is anticipated, even if it was found to occur within the project area.

Thickglum Reedgrass

This grass occurs in wet, marshy areas but not muskegs. It is not known to occur on Prince of Wales Island. The USF&WS has requested that this species not be considered at this time due to the recent taxonomic "lumping" of this species with the more common *C. stricta.*

Goose-Grass Sedge

No observations of this species were made during field reconnaissance of harvest units. This species is not known to occur in forested areas; therefore, no effects are anticipated from timber harvest.

Sensitive Species

Trumpeter Swan

Most timber harvest activity will not be in conflict with the TLMP RSDEIS (1996a) standards and guidelines for trumpeter swans, since swans are not present in the project area when most of the timber harvest activity occurs. There is a potential for conflict when swans are migrating through or returning to wintering areas. Noise from road construction, timber harvest, and hauling of logs could frighten swans away from their preferred resting and feeding areas. However, limiting timber harvest operations to periods when swans are not present (April 1 through November 1) will mitigate these potential impacts (see Mitigation Measures, Chapter 2); therefore, no effect on Trumpeter Swans is anticipated.

Osprey

Most timber harvest should not effect ospreys since they are not known to occur in the project area. They occur in low numbers throughout Southeast Alaska. There has been only one recorded sighting on Prince of Wales Island.

Peale's Peregrine Falcon

The Peale's subspecies nests on the outer islands to the west of the project area (Schempf 1981, 1982), and is not likely to be effected by this timber sale. The nest distribution of this subspecies is closely tied with large seabird colonies, which are believed to be their main prey. This subspecies is not listed as threatened, endangered, sensitive, or species of concern but is covered by a provision "similarity of appearance" which broadens the scope of protection for all peregrine falcons.

Prince of Wales Flying Squirrel

The Prince of Wales flying squirrel, which is found only on Prince of Wales Island, is one of 25 subspecies of flying squirrel. Although little is known about its population status or distribution, flying squirrels are "frequently" seen on Prince of Wales (Alaska Natural Heritage Program 1992). Since flying squirrels utilize old growth, the Chasina Project may affect the Prince of Wales Flying Squirrel.

Franklin's Spruce Grouse

The Franklin's spruce grouse is not listed as threatened, endangered, sensitive or a species of concern but is discussed due to the concern expressed by ADF&G. It occurs in low densities on and near Prince of Wales Island but has never been observed in the project area; therefore, the project is not expected to affect Franklin's spruce grouse.

Goose-Grass Sedge

No observations of this species were made during field reconnaissance of harvest units and roads. This species is not known to occur in forested areas; therefore, no effects are anticipated from timber harvest.

Edible Thistle

No observations of this species were made during field reconnaissance. Since timber harvest activities generally avoid wet meadows and stream margins where this species would be expected to be found, no direct effects from timber harvest are anticipated even if the species were to occur in the project area.

Davy Mannagrass

No impacts to this population as a result of road construction and timber harvest are anticipated because stream and lakeshore buffers should provide adequate protection for this plant.

Wright Filmy Fern

No observations of this species were made during field reconnaissance and no sightings have been documented in the project area. Since Wright filmy fern is not known to occur in the project area, no effects are anticipated from Chasina timber harvest activities. However, potentially undetected specimens could be affected by the removal of trees from damp woods of the project area.

Truncate Quillwort

No observations of this species were made during field reconnaissance and no sightings have been documented in the project area. Furthermore, due to its rooted aquatic nature, this species does not occur in forested areas; therefore, no direct effects from the Chasina Project are anticipated. Even if the species does exist in the project area, stream and lakeshore buffers should provide adequate protection for this plant.

Calder Lovage

No observations of this species were made during field reconnaissance and no sightings have been documented in the project area. Since Calder lovage is not known to occur in the project area, no effects are anticipated from Chasina timber harvest activities. However, potentially undetected specimens could be affected by the removal of timber along subalpine coniferous forest edges.

Choris Bog Orchid

Botanical surveys thus far have located one population of this species within the project area and more surveys are planned. This species has also been found in a number of other locations on Prince of Wales Island during 1995. With the increasing number of observations, it is possible that this species is not as rare as previously thought. With more surveys planned in the project area, it is likely that more populations of Choris bog orchid will be found. It is

also possible that timber harvest and road construction activities may affect Choris bog orchid by destroying some individual plants.

Bog Orchid

No observations of this species were made during field reconnaissance of harvest units and roads. This species is not known to occur in forested areas; therefore, there are no effects anticipated from timber harvest. Road construction activities may affect the bog orchid by destroying individual plants.

Loose-flowered Bluegrass

No observations of this species were made during field reconnaissance and no sightings have been documented in the project area. Since loose-flowered bluegrass is not known to occur in the project area, no effects are anticipated from Chasina timber harvest activities. However, potentially undetected specimens could be affected by the removal of timber from harvest units encompassing open lowland woods and open-forested meadows.

Straight-beak Buttercup

No observations of this species were made during field reconnaissance and no sightings have been documented in the project area. Since straight-beak buttercup is not known to occur in the project area, no effects are anticipated from Chasina timber harvest activities. Even if this species does occur in the project area, direct effects due to removal of timber from Chasina harvest units are not anticipated to be significant as the open and moist habitats in which these plants are known to occur are generally avoided for timber harvest.

Queen Charlotte Butterweed

No observations of this species were made during field reconnaissance and no sightings have been documented in the project area. Since Queen Charlotte butterweed is not known to occur in the project area, no effects are anticipated from Chasina timber harvest activities. Even if this species does occur in the project area, direct effects due to removal of timber from Chasina harvest units are not anticipated to be significant as the species preferred habitats are generally avoided for timber harvest.

Forest Health

Key Terms

Endemic—peculiar to a particular locality; indigenous.
Epidemic—rapid spread or sudden prevalence of a disease.
Phloem—the tissue in plants that conducts foods such as sugar.
Xylem—the tissue in plants that conducts water and substances in solution.
Sapwood—the softer part of wood, between the inner bark and the heartwood.

Affected Environment

Forest insects and diseases are normal components of the forested sites in the Chasina Project Area. Some of them exist, and will continue to exist, at endemic levels. Even at low levels of infestation or infection, forest insects and diseases have considerable effects on forest dynamics and resource management values. When they proliferate and become epidemic, the consequences to the forest can be dramatic. Currently there is no indication that insects or diseases are a potential problem in the Chasina Project Area.

Insects

The two most common types of destructive insects found in the Chasina Project Area are defoliators and bark beetles.

Forest Defoliators

Forest defoliators eat the leaves or needles of forest trees. Unlike bark beetles, defoliators usually do not kill trees, but slow down tree growth and increase susceptibility to secondary attack by other insects and diseases. All species of trees are not equally susceptible to injury from defoliation. Hardwood species can usually withstand several years of defoliation because they store large food supplies and can refoliate in the same year. Conifers, on the other hand, may be killed by a single defoliation if it occurs prior to bud formation in midsummer.

The two most common forest defoliating insects that occur within the project area at endemic levels include the following:

Black-headed budworm

Black-headed budworm, *Acleris gloverana* (Wals) is one of the most destructive forest insects in coastal Southeast Alaska. In the 1950s, almost one-third of the net timber volume was lost on some hemlock sites due to budworm defoliation. Larvae usually confine their feeding to new growth. In large concentrations, the larger larvae will feed on older needles. Budworm defoliation can result in growth reduction, top-kill, and, at times, tree mortality. Budworm populations are characterized by sporadic spectacular increases followed two to three years later by equally rapid declines.

Hemlock sawfly

Hemlock sawfly, *Neodiprion tsugae* (Middleton) is a serious defoliator of western hemlock throughout Southeast Alaska. Outbreaks tend to be more severe and of longer duration in the area south of Frederick Sound, especially along Clarence Strait. Larvae feed on mature foliage rather than the current year's foliage. Most sawfly outbreaks do not cause tree mortality, but some trees are top-killed and radial growth may be reduced. Tree mortality becomes more likely when sawfly and black-headed budworm populations coincide. This is due to the feeding habits of the two defoliators; the budworm feeds on the current year's foliage, whereas sawflies consume previous year's foliage. Natural controls usually reduce epidemic sawfly populations within a few years. Wetter than normal summers help reduce sawfly populations by favoring conditions for fungal growth. Fungi readily infect and kill sawfly larvae under warm, damp conditions. Low summer temperatures can also delay sawfly development and reduce the opportunities for successful egg laying. Eventually starvation and poor nutrition brought about by depletion of the host foliage will also contribute to the population collapse.

Bark Beetles

Bark beetles are probably the most destructive forest insect in Alaska. Bark beetles prefer to breed in weakened host material. However, during favorable climatic periods for beetle development, populations may build up rapidly and healthy trees are successfully attacked. Bark beetles girdle the phloem which, in turn, disrupts the downward movement of nutrients. Some bark beetles, notably those of the genus *Dendroctonus*, have a symbiotic relationship with blue-stain fungi. The blue-stain fungi can completely penetrate the sapwood within a year. The fungi plug up the outer conducting tissues in the xylem which halts upward water movement. This action, plus that of the bark beetles, can cause the death of a host tree.

Spruce Beetle

Spruce Beetle, *Dendroctonus rufipennis* (Kirby) outbreaks have been noted across the Tongass National Forest and adjacent lands in previous years. The spruce beetle life cycle is 2 years, with adult beetles emerging in late May to early June in search of susceptible host material (spruce logs). Dispersing adults can fly for long distances, over 7 miles nonstop. Adult mortality during dispersal is quite high. Female beetles are attracted to windthrow and other downed material. Beetles prefer to attack the sides and bottoms of downed material because of favorable temperature and moisture regimes for brood development. Males are attracted to the site via airborne chemicals produced by the female beetles.

Most outbreaks originate in blowdown or logging residuals (cull logs) and spread to adjacent standing timber. Mortality in unmanaged Sitka spruce stands varies and can be as high as 75 percent.

Diseases

Some of the more common diseases and other forms of damage are discussed below.

Hemlock Dwarf Mistletoe

Hemlock Dwarf Mistletoe, *Arceuthobium tsugense* (Rosendhal, G. N. Jones) is a destructive disease of western hemlock throughout the project area. Infestation levels vary in old-growth hemlock stands. Dwarf-mistletoe is absent in some stands and in other stands almost every hemlock is infected. The volume of western hemlock trees heavily infected with dwarf-mistletoe can be reduced as much as 50 percent over a 100-year period. Dwarf-mistletoe is species specific and rarely infects Sitka spruce and mountain hemlock.

The spread of dwarf-mistletoe in young hemlock stands is often the result of leaving standing infected hemlock in cutover areas (TLMP RSDEIS 1996a). Dwarf-mistletoe responds to light with increased seed production. Rates of spread to adjacent and lower canopy trees will increase in partial cuts where infected hemlocks remain.

Other

Alaska Yellowcedar Decline

Alaska Yellowcedar decline leads to reduced growth and eventual death of Alaska yellowcedar, is a widespread problem throughout the project area. This decline is associated with wet, poorly drained sites, and recent research has demonstrated that the primary cause of decline cannot be attributed to any contagious organism. Since it is not contagious, Alaska yellowcedar decline will not spread to sites where it is not found now (TLMP Draft Revision 1991a, pp. 3-117). Because Alaska yellowcedar has high timber value, this annual mortality represents a significant loss in timber value. In addition, substantial acres of old-growth cedar forests have been harvested and are regenerating to other species. The regeneration of Alaska yellowcedar will be specifically considered where it forms a significant component of a site proposed for harvest.

Hemlock Fluting

Hemlock fluting results in deeply incised grooves and ridges that extend vertically along the trunk of the tree. This condition reduces the value of hemlock logs because they yield less sawlog volume and because some of the milled wood contains bark. The cause of hemlock fluting is a mechanical response to wind and is generally found at low elevations near the coast. Some sites are heavily affected, to the point of making the stand unsaleable, while other sites have relatively light or no damage.

Decays

Decays that affect the stem and root systems are probably the major cause of volume loss within the project area. Many decay fungi enter through tree wounds. The accidental wounding of trees during partial cuts and commercial thinnings will increase the impact from decay organisms in managed stands.

Trees are susceptible to a sequence of diseases at different stages of their growth. Early susceptibility thins a forest stand resulting in more vigorous crop trees. In turn, late susceptibility removes the older and more decadent trees, making room and preparing the way for new trees.

Effects of the Alternatives

Specific pests will be affected differently by each of the alternatives. In general, increasing timber harvest will decrease the impacts of the spruce beetle and timber volume loss by pests such as wood decay fungi and hemlock dwarf mistletoe. From the perspective of timber management, the health of the forest is increased through timber harvesting. However, many of these pests also contribute significantly to ecosystem diversity and long-term stability in old-growth stands by providing increased canopy diversity and animal habitat, and by causing the formation of small scale gaps.

In general, endemic levels of insect and disease activity in mature and overmature forests will be allowed to run their course. Tree losses will be accepted. Salvage logging that exceeds the intent of "minor changes" as defined under the timber sale contract and/or direct control measures will require additional NEPA analysis prior to implementation. The action alternatives all have the same relative environmental consequences from a pest management standpoint regardless of whether viewed from a timber production or a biodiversity perspective.

The previous statement is true as long as the range of silvicultural systems applied remains constant across all alternatives. Partial cuts that retain overstory trees can result in western hemlock (the most tolerant species) forming a much larger percentage of the future stand composition. Sitka Spruce, western redcedar, and Alaska yellowcedar occurrence in these sites would be greatly reduced. Partial cutting would increase dwarf-mistletoe infection. Unless a large investment were made to sanitize the stand (remove infected trees) periodically, the future value of the site for timber production could be reduced or even eliminated from an economic standpoint.

Silviculture and Timber

Key Terms

Advanced Regeneration — natural conifer reproduction established beneath an existing forest canopy; comprised of trees ranging from 5-20 feet in height.
Allowable Sale Quantity (ASQ) — the maximum quantity of timber that may be sold in each decade from suitable scheduled lands covered by the Forest Plan.
Basal Area (BA) — the area of the cross section of a tree stem, or group of trees, measured at 4.5 feet above ground; usually presented as total square feet per acre.
Blind Lead — an area within a harvest unit that is difficult to yard (remove felled timber) with conventional cable logging systems on convex slopes.
Climax Plant Community — the final or stable biotic community in a successional series which is self-perpetuating and in dynamic equilibrium with the physical habitat; the assumed end point in succession.
Commercial Forest Land (CFL) — land that is capable of producing continuous crops of timber (20 cubic feet of tree growth annually, or at least 8 MBF)/acre.
Desired Future Condition or Goal — a concise statement that describes a desired future condition normally expressed in broad, general terms that are timeless, in that there is no specific date by which the goal is to be achieved (36 CFR 219.3).
Duff Layer — vegetative material covering the mineral soils in forests including the fresh litter and well-decomposed organic material and humus.
Ecosystem — all of the organisms in a given area interacting with the physical environment so that the flow of energy leads to an exchange of materials between living and nonliving parts within the system.
Ecosystem — the complete system formed by the interaction of a group of organisms and their environment.
Even-aged System — a planned sequence of treatments designed to maintain and regenerate a stand with one age class. The range of tree ages is usually less than 20 percent of the rotation age.
Falldown — the difference between planned or scheduled harvest and that which is attained after implementation.
Forestland — land at least 10 percent occupied by forest trees of any size, or formerly having had such tree cover and not currently developed for non-forest use.
Managed Stand — a stand of trees in which stocking level control is applied to achieve maximum growth.
MBF — thousand board feet.
Logging System Transportation Analysis Plan (LSTA) — interdisciplinary design and mapping of all potential timber harvest units, including associated logging and transportation systems, within a project area.
Mid-market analysis — the value and product mix represented at the quarter in which the pond log value _end-product selling price less manufacturing cost) for the species and product mix most closely matches the point between the ranked quarters of the Alaska Index Operation pond value, adjusted to Common Year Dollars, where one half of the harvest of timber from the Tongass National Forest has been removed at higher values and one half of the timber has been removed at lower values, during the period from 1979 to the current quarter (FSH 2409.22 R10 Chapter 531.1-2).

MMBF — million board feet.
Partial cut — method of harvesting trees where any number of live trees are left standing in any of various spatial patterns; not clearcutting.
Plant Association — a basic unit of vegetation classification based on land management potential, species composition, successional patterns, and the climax plant community.
Precommercial Thinning — the practice of removing some trees of sapling size to reduce stocking and improve tree growing space; trees will grow faster due to reduced competition for nutrients, water, and sunlight.
Reserved — lands that have been withdrawn from the timber base by an Act of Congress, the Secretary of Agriculture, or the Chief of the Forest Service.
Retained Structure — merchantable or submerchantable trees and snags that are left within the harvest unit to provide biological habitat components over the next management cycle.
Shade Tolerance — plant species physiological growth adaptation to shade conditions; shade tolerant species such as western hemlock are able to live in shaded conditions whereas shade intolerant species such as spruce are not adapted to shaded conditions.
Silvical Characteristics — physiological and genetic characteristics of individual tree species and the ecological characteristics (biological and environmental factors) of the site which enable specific species to be adapted to a particular and unique site.
Silvicultural Practices — management techniques used to modify, manage, and replace a forest over time. Silvicultural practices are classified according to the method of carrying out the process (shelterwood, seed tree, clearcut, commercial thinning, etc.).
Silviculture — the art, science, and practice of controlling the establishment, composition, structure, and growth of trees and other vegetation in forest stands.
Site Index — a measure of a forest areas relative productive capacity for tree growth. Measurement of site index is based on height of dominant trees in a stand at a given age.
Succession — a series of dynamic changes by which one group of organisms succeeds another through stages leading to a potential natural community or climax. The process of plant community development after disturbance involves changes in species composition over time.
Suitable Forestland — commercial forestland identified as having the biological capability to sustain long-term timber production and administratively designated for such production.
Uneven-aged Management — management techniques that result in the creation of stands that exhibit a range of diameter or age classes.
Volume Class — classification system used to differentiate timber stands into similar average volume per acre categories or strata.
Windfirm Trees — trees that have been exposed to the wind throughout their life and have developed a strong root system or trees that are protected from the wind by terrain features.
Windthrow — the act of trees being uprooted by the wind. Three types of windthrow include: endemic, where individual trees are blown over; catastrophic, where a major windstorm can destroy hundreds of acres; and management related, where the clearing of trees in an area make the adjacent standing trees vulnerable to windthrow.

3 Environment and Effects

Affected Environment

Introduction

Ecosystem Management is a new term that emphasizes an old concept. It incorporates management by objectives with due consideration for biological, physical, social, and economic factors. The salient points are two-fold: (1) management of the forest resources must consider a full range of resource objectives that include commodity and noncommodity outputs; and (2) management must be practical and achievable. The second objective includes the physical and biological limitations which serve to restrict the range of treatments and objectives that can be achieved on a particular site. Choices are based on matching the attributes of the silvicultural systems with specific management objectives and ecological characteristics for specific stands and landscape levels.

Silviculture is the art and science of controlling the establishment, growth, health, composition, and quality of forests and woodlands to meet the diverse needs and values of landowners and society. This should be sustainable in the long run and in the context of human activity and use.

Silvicultural systems are used to tend, harvest, and re-establish forest stands. A stand is a forest community possessing sufficient uniformity in composition, age, spatial arrangement, or condition. A stand is distinguishable from adjacent stands and is capable of being mapped. A silvicultural system is a program of treatments applied throughout the life of the stand; it is the process by which the stand is grown for a specific purpose and it is the means of reaching a desired future condition. This process includes the harvest or regeneration of the stand, intermediate cuttings, and other cultural treatments necessary for the replacement and development of the forest stand. No single silvicultural system can produce all desired combinations of products and amenities from a particular stand or project area. Reconnaissance systems are applied through prescriptions. A prescription is a written record of stand examination and diagnosis, and includes treatment regimes prescribed for the stand. Prescriptions are prepared and written by a certified silviculturist.

Forested Plant Communities

Plant Series

The natural vegetation of the reconnaissance project area is a mosaic of coniferous forest interspersed with alpine tundra, muskeg (bog), shrubland, estuarine, and beach fringe plant communities. The project area has been classified into forested plant associations, using the Tongass Forest Plant Association Management Guide (DeMeo 1992), which are based upon the climax plant community. The climax plant community is the result of the interaction between landform, climate, soils, and time. All forested plant associations having the same climax tree(s) are referred to as a series and are named based upon the climax tree(s). The Chasina Project Area has seven plant series. Forested plant communities, displayed by VCU in Table ST-1, are described below.

Sitka Spruce Series

Plant associates in this series are dominated by Sitka spruce (*Picea sitchensis*) in the overstory. Western hemlock (*Tsuga heterophylla*), the principal co-dominant, may be common and is generally overtopped by the spruce. Red alder may also be present. This series is located primarily at low elevations in well-drained alluvial fans, riparian areas, or avalanche chutes. It is also found at mid-elevations on steep mountain slopes adjacent to

channels, along snow avalanche paths, on slopes subject to mass wasting, and on sites subject to annual deposits of loss.

Soils are generally deep (more shallow soils generally occur upslope), poorly developed, and well drained, with a thin organic layer on the surface. Soil disturbances allow the spruce and shrub species, such as devil's club (*Oplopanzxc horridum*), blueberry (*Vaccinium* spp.), and salmonberry (*Rubus spectabilis*) to maintain dominance on these sites. Ferns and skunk cabbage are the dominant herbs.

Seedlings of both western hemlock and Sitka spruce series are present, but conditions favor spruce regeneration. This series is generally highly productive and the heights of mature spruce often exceed 150 feet. These communities seem to represent stable late-seral or climax units (Viereck et al. 1992).

Western Hemlock Series

This series has comprised the majority of suitable forested sites on the project area. Plant associations in this series generally occur in the uplands on mountain-, hill-, and foot-slopes with moderate to well-drained soils. The predominate overstory tree species is the western hemlock, but Sitka spruce occurs in the overstory in relation to the frequency of disturbance. The shrub layer is dominated by blueberry and rusty menziesia; devil's club, however, can be a major component in some areas. Bunchberry and five-leaf bramble dominate the herb layer, but skunk cabbage can be a major component in areas with poorly drained soils. Plant productivity is generally high, with mature hemlock often exceeding heights of 125 feet.

The western hemlock series generally occurs from lowlands to the subalpine on several landforms including inactive alluvial fans and floodplains, footslopes, and steep mountain slopes. Soils usually are deep and well drained with a thin (4 to 6 inch) forest floor layer. These communities are usually stable (climax) (Viereck et al. 1992).

Mixed Conifer Series

Mixed conifer associations designate sites with limited productivity due to poor soil drainage, shallow soil, or both. Since tree growth on these sites is low, recovery from severe disturbance would likely also be slow (Viereck et al. 1992). These plant associations generally occur in the uplands, often near muskegs. Dominant overstory tree species are mountain hemlock, western hemlock, western redcedar (*Thuja plicata*), and yellowcedar. Sitka spruce and shore pine can also occur. Blueberry and rusty menziesia are the dominant shrub species. Dominant herbs vary and include skunk cabbage, five-leaf bramble, deer cabbage, and ferns.

Western Hemlock-Yellowcedar Series

This series can be considered a subset of the western hemlock series on the project area. It is most common on mountains and hillslopes around 1,000 feet elevation, but can be found from sea level to the subalpine zone. Dominant overstory tree species are western hemlock and yellowcedar; western redcedar may also be present. Hemlock seedlings are abundant while yellowcedar seedlings are uncommon. This series occurs at all elevations below the subalpine zone, but is primarily found on mountain slopes and hillsides where drainage or root growth is impeded. Blueberry is the dominant shrub, with rusty menziesia common. Dominant herbs vary and include ferns, bunchberry, dogwood, skunk cabbage, and five-leaf bramble. Site productivity is best described as moderate. These communities are though to be climax. When sites supporting these communities are logged they tend to come back to blueberry and

rusty menziesia if the soil is not seriously disturbed, and to Sitka alder (*Alnus sinuata*) and salmonberry if the soil has been seriously disturbed (Viereck et al. 1992).

Western Hemlock-Western Redcedar Series

This series represents a transition from the less productive, poorly drained mixed conifer series, to the more productive, better drained western hemlock series. It occurs on a wide variety of landforms, but is most characteristic of rolling hill country, and lower hill- and mountain-slopes. Near the northern limit of its range, redcedar growth is limited by light and temperature. Consequently, while it may be found up to 1,000 feet above sea level, it is most common below 500 feet.

The overstory is dominated by western hemlock. Redcedar commonly occupies 10 to 25 percent of the forest canopy. Yellowcedar may also occur. Other species are incidental. The understory is characterized by blueberry, although salal may be locally common on warmer sites below 500 feet elevation. Site productivity is typically low to moderate on rolling hills and moderate to high on hill and mountain-slopes. Poorer sites allows redcedar to compete with other conifers.

Shore Pine Series

This group of associations is on the transition line from mixed conifer to non-forest muskeg. Soils are poorly drained and productivity is very low. Understory vegetation, because of the abundant light available, is very diverse. Muskeg plants such as Labrador tea, crowberry, bog kalmia, bog blueberry, and sedges are common. Salal may occur on some sites.

The shore pine series is a low-productivity series with overstory dominated by shore pine. Scattered yellowcedar, redcedar, and mountain hemlock may also be present in the overstory. These sites are either level or gently sloping and most commonly occur on lowland plateaus with deep organic poorly drained soils. The shore pine series are climax communities.

Table ST-1 displays the approximate percent of area occupied by each plant series found in the Chasina Project Area.

Table ST-1
Acres of Forested Plant Communities (by VCU)

VCU	Sitka Spruce	Western Hemlock	Mixed Conifer	Shore Pine	Western Hemlock Yellow Cedar	Western Hemlock Western Redcedar	Alder Scrub-land	Sphagnum Muskeg	Rock
674	149	60	142	0	12	733	678	0	48
677	0	1,189	715	0	92	322	8	0	301
678	233	4,337	68	0	400	2,368	2,240	58	1,493
679	213	6,347	4,494	49	28	746	179	436	0
680	9	862	2,566	0	0	679	0	51	0
681	195	1,637	1,530	21	0	613	413	545	0
682	0	2,041	1,074	0	0	847	0	272	0
Total	**887**	**16,473**	**10,589**	**70**	**532**	**6,308**	**3,518**	**1,362**	**1,842**

Source: This information derived from Ketchikan Area GIS, CLU data layer.

Non-Forested Plant Communities

Various non-forest plant communities occur in estuaries, riparian areas, muskegs, alpine meadows, and alpine lichen rock outcrops in the Chasina Project Area. Non-forested plant communities, displayed by VCU in Table ST-2, are described below. Harvesting will not occur in these communities.

Estuary Tidal Flats

Estuary tidal flats are inundated by high tides. Vegetation consists primarily of sedges, red fescue, and sea milkwort. Bluejoint and sedges dominate on low terraces, which are rarely inundated by tides, but have high water tables. This also includes unvegetated mud flats.

Shrub Riparian Areas

Shrub riparian areas are found on highly active floodplains and are frequently disturbed. Soils are generally deep and well drained, but flood frequently. Salmonberry, stinkcurrant, devil's club, and ferns are the dominant vegetation.

Muskegs

Muskegs are most often characterized by stunted yellowcedar and shore pine, along with sedges and other bog vegetation. Muskegs dominated by sphagnum moss or tall sedge cover smaller areas. The water table is at the surface, and numerous small ponds are scattered throughout the muskeg.

Alpine Meadows

Alpine meadows are dominated by cassiope and mixed forbs including mountain heather. These meadows are found on steep, well-drained rock outcrops at high elevation. Alpine lichen rock outcrops are found at high elevations above timberline. Plant cover does not exceed 50 percent. Species diversity is high and includes cassiope, clubmoss, and grass species.

Table ST-2 displays the acres of area occupied by each non-forest plant series found in the Chasina Project Area.

Table ST-2
Distribution of Non-Forest Plant Communities (By VCU)

VCU	Estuary Tidal Flats	Scrub/ Shrub	Sphagnum Muskeg	Alpine Meadows	Rock	Total Non-Forested Land
674	0	0	0	109	40	**149**
677	4	566	27	70	322	**989**
678	11	1,696	260	661	1,859	**4,487**
679	24	76	81	462	0	**643**
680	7	0	3	44	0	**54**
681	0	0	111	100	0	**211**
682	13	12	3	0	0	**28**

Source: This information derived from Ketchikan Area GIS, CLU data layer.

Site Class

Site class is a measure of the relative productive capacity of a parcel of land for tree growth. This measure is used to predict future timber yields and to set silvicultural priorities. Site class is a function of soil type, the productive potential of the soil, and topographic position. Estimates of site productivity in Southeast Alaska old-growth stands are best obtained by examining the soil. The soil-site relationships have been developed primarily upon depth and drainage of soil and parent material (Ruth and Harris 1979).

Soil classification mapping was conducted on Prince of Wales Island to provide broad information on soil types and their implications on management activities. Soil mapping is conducted through aerial photo interpretation of existing vegetation and correlating field-verified soil/vegetation relationships. These procedures provide a high level of confidence in the soil classification over large areas, but may result in inaccurately mapped soil types at the local level. The distribution of site classes, as mapped in GIS, throughout the project area is shown in Table ST-4.

Table ST-3
Site Class Descriptions

Site Class	Site Index (Height in ft. @ 50 yrs)
1	0 to 40
2	41 to 60
3	61 to 80
4	80 plus

Table ST-4
Acres in Each Site Class (Productivity Group by VCU)

		Site Class				
VCU	Unclassified	1 Very Low	2 Low	3 Medium	4 High	Total
674	0	159	724	832	209	**1,924**
677	223	1,087	295	866	806	**3,277**
678	13	2,587	3,136	2,398	2,852	**10,986**
679	2,051	576	1,751	3,680	4,991	**13,049**
680	66	55	1,539	1,931	340	**3,931**
681	1,938	145	1,359	1,976	1,247	**6,665**
682	27	82	561	2,304	1,445	**4,419**
Total	**4,318**	**4,691**	**9,365**	**13,987**	**11,890**	**44,251**

SOURCE: Forest Service, Ketchikan Area, Data Base.

Silvicultural Systems

Silvicultural systems are a planned process whereby a stand is tended, harvested, and re-established (Silviculture Terminology 1994). The system name is based on the number of age classes present. They can be grouped into even-aged and uneven-aged systems, depending on the type of age structure that is created. Even-aged systems produce stands that consist of trees of the same or nearly the same age. A stand is considered even-aged if the range in tree ages normally does not exceed 20 percent of the rotation age—the age at

which the stand is harvested. Seed tree cutting, shelterwood cutting, and clearcutting will produce even-aged stands. Even-aged stands have a beginning and an end point in time. Uneven-aged systems create stands that include three or more distinctly different age classes, with no overall beginning or end point in time. Both even- and unevened-aged silvicultural systems are approved for the Chasina Project Area.

The selection of the appropriate silvicultural system is dependent upon the feasibility of achieving sound silvicultural objectives. These include such objectives as species composition, stand density, growth rate, insect and disease control, and overstory condition and development.

The next step is to use the Forest Plan, management concerns, and public issues to refine site-specific objectives. It is possible that more than one silvicultural system may be prescribed for the same site, depending upon the alternative in question.

Even-Aged Systems

Even-aged systems produce distinct successional stages and there are even-aged stands of various ages and sizes distributed throughout the managed forest. Therefore, even-aged forests have relatively low vertical diversity, but have a high degree of horizontal diversity—the forest is a mosaic of forest and openings. The low vertical diversity is a result of the comparatively simple structure of the even-aged stand.

Clearcutting Method

This method involves the removal of the entire stand in one cutting, and reproduction is obtained artificially or by natural seeding from adjacent stands. In the narrowest sense, the cutting operation includes all standing woody vegetation. A variant of this method includes felling only merchantable trees, and with careful harvest technique, retaining the existing advance regeneration. This method is similar to large-scale disturbances such as wildfire or windstorms. The primary objective of this method is to reestablish an even-aged stand by removing the mature one. Decisions to clearcut are usually based on a number of factors such as insect epidemics, disease, fire, decadent stand conditions, desire to change species, desire to introduce genetically superior trees, windfirmness, soil conditions, or desire to meet the needs for regulating volume production through area control.

The clearcutting method with natural regeneration is the most commonly used system on the Tongass National Forest. The system works well, but natural regeneration is usually too abundant. The reproduction is derived partly from wind-dispersed seed, but mostly from advance reproduction that survived the logging operation.

Silvicultural advantages of the clearcutting method can be listed as follows: (1) it permits longer cable yarding distances than would be practical in partial cutting, permitting wider road spacing and reduced road costs, resulting in less soil disturbance caused by road construction; (2) exposure to the sun raises soil temperatures, which speeds decomposition of the organic forest floor, thereby improving the productivity of the forest site; (3) it favors the regeneration of Sitka spruce by destroying advance hemlock regeneration (reduces competitive advantage of the hemlock) and disturbing the forest floor, creating seed beds that are more favorable for post-logging reproduction of spruce; (4) it provides an effective means of controlling dwarf mistletoe provided the clearcut is approximately 20 acres or larger. This is because the rate of spread from adjacent infected stands will proceed at a very slow rate into a regenerated clearcut unit. In an uneven-aged system, the infected overstory

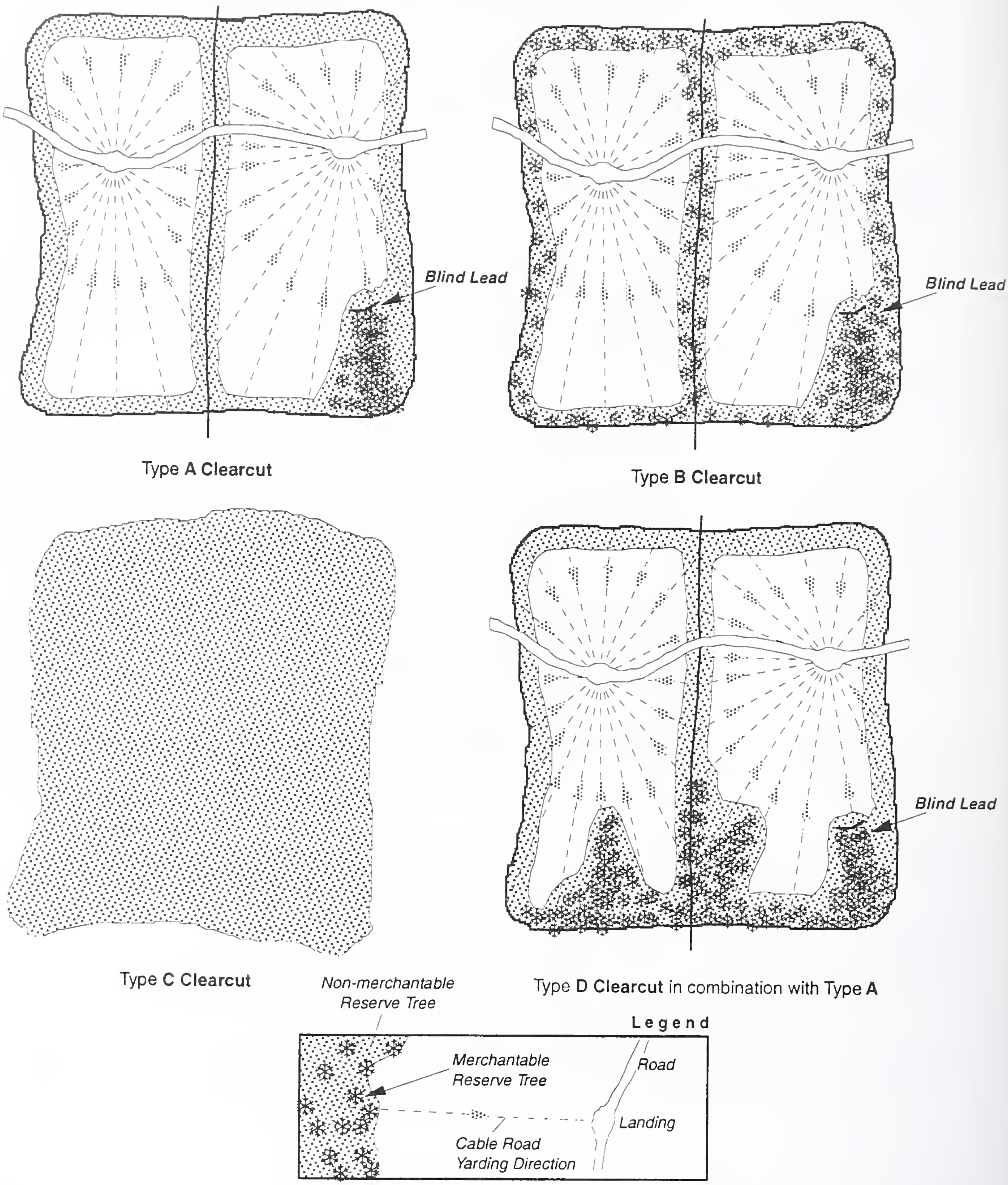
trees will likely still remain in the stand and be present to infect the regeneration; (5) eliminates the risk of blowdown in residual stands; (6) no logging damage to adjacent standing timber and minimum damage to residual stands; and (7) logging costs are lower than with other systems and frequency site disturbance is minimized.

Silvicultural disadvantages of clearcutting are: (1) seedling distribution is uneven and parts of an area may become understocked or overstocked; (2) species control is minimal; (3) the chance of blowdown along cutting boundaries is increased, but may be reduced through proper design of cutting units; (4) it tends to reduce protection against erosion, landslides, and rapid runoff of water; (5) it is esthetically the least desirable method because of the heavily altered appearance of recently harvested areas; and (6) unmerchantable trees may be cut and utilized.

A variety of options can be employed to enhance wildlife values and visual quality associated with clearcutting. Reserve trees (green tree retention), or snags, can be retained in clumps or as individual trees throughout the unit, specifically along setting edges, in blind leads, or in other areas that are difficult to log (Forest Service 1993). These reserve trees provide for greater structural diversity and higher snag densities in the regenerated stand and lessen visual contrast between the clearcut and adjacent old growth.

Clearcuts incorporating reserve trees can be categorized into four types. Type A clearcuts leave safe snags and nonmerchantable reserve trees within a 50 to 100 foot border along harvest unit edges and nonmerchantable trees near internal setting boundaries if safety is assured. In this case, trees are directionally felled toward the landing and carefully yarded out of the buffer. Type B clearcuts are similar, except a specified number of snags and live tree replacements with minimum diameter limits are retained in the 50 to 100 foot border. Due to the flexibility of setting boundaries, the live reserve trees may only be required wherever a stream buffer is called for. Types A and B clearcuts are practical for implementation with cable yarding. Type C clearcuts would leave nonmerchantable trees and safe snags over the entire unit. This type of clearcut can be used with helicopter yarding. Type D clearcuts would provide clumps of reserve trees in islands or fingers within the unit. This type can be implemented where rock outcrops, cliffs, or blind leads make harvesting uneconomical or infeasible. In addition, clumps of reserve trees can be left in other areas if helicopter yarding or cable yarding with lateral yarding capability is the logging system to be employed. A Type D clearcut can be prescribed by itself or in combination with one of the other three types. Figure ST-1 provides a schematic diagram of these types of clearcutting.

Figure ST-1
Schematic Diagram of Clearcut Types With Reserve Trees



Currently, the project area contains 1,545 acres of seedlings and saplings. Seedlings and saplings are trees less than or equal to 4.9 inches in diameter at breast height (dbh). There are 420 acres of poletimber and young sawtimber (5 inches to 9 inches dbh) sized stands. All of these sites were previously harvested using the clearcut silvicultural method and are planned for future even-aged management.

Seed-tree Method

This method involves the removal of an old stand in one harvest entry, leaving a small number of trees left standing singly, in small groups, or in narrow strips, as a source of seed for natural regeneration. This method mimics a large-scale disturbance such as severe windthrow, which leaves a few mature trees per acre to serve as a seed source.

Silvicultural advantages of the seed-tree method are: (1) better distribution of seed occurs as compared with clearcutting; (2) it retains better species composition than with clearcutting; (3) it can regenerate extensive areas of timber in areas too large to be seeded naturally from adjacent stands; (4) logging costs are low; (5) it achieves slightly better aesthetics than clearcutting; and (6) seed trees add some vertical diversity.

Silvicultural disadvantages of the seed-tree method are: (1) it is limited to windfirm trees and it is not feasible where seedtrees will be blown over by wind; (2) control of spacing and the timing of the new crop is difficult; (3) it is costly to harvest seed trees, and damage occurs to regeneration; (4) soil protection is not much different than clearcutting; (5) it is commonly limited to light-weight-seeded species; and (6) it is inappropriate when the seed trees have infestations of hemlock dwarf mistletoe (a parasitic plant).

The seed tree method could be used in Southeast Alaska on a very limited basis where small areas of understocking may occur, or where cedar stocking is to be maintained.

Shelterwood Method

This method involves the establishment of a new stand under the canopy of the old stand. Shelterwood cuttings mimic large-scale natural disturbances in which many trees are lost and the residual large trees may provide seed and may shelter the natural regeneration from extreme heat and cold. Hemlock and spruce lend themselves to shelterwood cutting because both species can become established under a forest canopy.

Silvicultural advantages of the shelterwood method are: (1) it allows ultimate control of site conditions for the regeneration of even-aged stands; (2) natural regeneration is usually more certain than the seedtree or clearcut method because there is a more abundant source of seed; (3) good soil protection is provided; (4) it is superior to all methods, except selection, with respect to protection of site and aesthetic considerations; (5) it can be applied to large areas; (6) it provides the best control over species composition, amount, and distribution; and (7) sheltering trees add some vertical diversity.

Silvicultural disadvantages of the shelterwood method are: (1) logging costs are increased because of the returns to the same area for smaller volumes and the care exercised to prevent excessive damage; (2) it requires a fairly windfirm species and it is not feasible where the sheltering trees will be blown over; hemlock and spruce rarely exhibit windfirm characteristics; (3) unavoidable damage to the residual stand and regeneration occurs during logging, particularly on cable ground; (4) it is inappropriate when the sheltering trees have infestations of dwarf mistletoe; (5) several Oregon studies in hemlock-spruce stands suggest

that overstocking of regeneration can be expected; (6) it is difficult to maintain spruce in the understory because hemlock can tolerate more shade than spruce; (7) growth rate of seedlings is slower under shade; and (8) logging safety could be compromised with leave trees in cable yarded units. Like the seed-tree method, this method has limited applicability to Southeast Alaska.

Uneven-aged Systems

Uneven-aged silvicultural systems produce stands of much greater structural diversity than even-aged systems. The diversity is due to the numerous age classes, clumpiness of tree distribution, and generally the presence of a greater number of species within the stand. Regulation of an uneven-aged forest is based on maintaining a range of tree diameters (and ages) with the largest number of trees per acre in the youngest and smallest diameter classes. As trees increase in size and maturity, their numbers are reduced through harvest.

Uneven-aged management can be used in certain areas to meet specific visual resource needs, provide habitat for wildlife, afford additional protection to sensitive resources, and address recent public concern over the use of clearcutting. The uneven-aged system can take the form of individual tree selection, diameter cuts, and group-selection cuttings. Diameter cuts have been included in the uneven-aged system because all larger trees down to a specified diameter, unique for each species, would be harvested. This method of cutting will, over time, create stands with trees of varying ages and sizes. Uneven-aged management opens up opportunities to harvest timber where even-aged management would result in unacceptable impacts to other resources.

This system has not been tested extensively in the hemlock-spruce type of Southeast Alaska.

Single-tree Method.

Trees are removed individually at random from a large area. This method simulates natural disturbances caused by the death of scattered trees. Regeneration occurs under the partial shade of larger trees and seedlings must be able to grow in a shaded environment. Sitka spruce and western hemlock are adapted to grow in a shaded environment. Under the selection method, the stand always has some relatively old trees. Some of the cuttings may be intermediate in immature age classes. Each tree is evaluated for its contribution to the desired characteristics of the stand.

Silvicultural advantages of the single tree selection are: (1) it is capable of maintaining an uneven-aged stand; (2) reproduction of tolerant species is easily obtained; (3) seedbed site protection is excellent with little or no exposure to insolation (exposure to sunlight) and wind; (4) stands can be readily adapted to changing market conditions; and (5) it usually has the highest aesthetic rating.

Silvicultural disadvantages of the single-tree selection method are: (1) highly skilled people are needed to practice it; (2) logging costs are much higher because of the small volume per acre, the frequent entries required to each stand, the complexity of the logging systems, and the care necessary to hold damage to an acceptable limit; (3) crop trees are scattered throughout the stand; (4) risk of wind damage within the stand increases with partial cutting; (5) a more extensive road system needs to be constructed and maintained to secure the same volume of timber as obtained by use of other systems; (6) it would not be suitable for hemlock stands infected with dwarf mistletoe; (7) frequent light entries can result in accelerated stand deterioration as the stand is opened up to wind, and damage can be done to

boles and roots of residual trees from felling and yarding tall, large-diameter, defective trees; and (8) shade tolerant western hemlock would eventually replace spruce and cedar species within the stand.

Group Selection Method

Trees are harvested in small groups (usually less than two acres). The openings created in the stand resemble miniature clearcuts and the uneven-aged stand is composed of a mosaic of even-aged groups; the small openings simulate small natural disturbances.

Silvicultural advantages of the group selection method are: (1) the regeneration in the small groups grows up under even-aged conditions and better stem form is obtained; (2) harvesting is more concentrated so logging costs are lower than single-tree; (3) harvesting in groups lowers damage to the residual stand; (4) it tends to increase diversity of plants and animals because of a temporary increase in shade intolerant plants in the small openings; (5) intermediate cuts may be made less frequently without sacrificing diameter class distribution although composition may be affected; (6) the small groups may be esthetically more acceptable to some people; and (7) the small openings would be more favorable for spruce and cedar regeneration.

Silvicultural disadvantages of the group selection method are the same as the single-tree method but to a lesser degree. The major limitations on its use are the operational difficulties in the steep, rugged topography found in the project area. Helicopter yarding or a pattern of small uphill yarded cable corridors may prove to be feasible in Southeast Alaska.

Ecosystem Management

Ecosystem management is defined as an ecological approach to resource management at the landscape level that blends social, physical, economic, and biological processes to ensure the sustainability of healthy ecosystems while providing desired values, goods, and services (Silviculture Terminology 1994).

Under ecosystem management, new silvicultural strategies are examined, and older strategies re-evaluated, to bring about a different balance in resource production in managed forests. The basic philosophy of this concept is to mimic natural ecological processes and to maintain options for future management while more knowledge becomes available about the impacts of forest management activities on the ecosystems.

Ecosystem management looks at the forest on two levels: (1) the landscape level, which may be a VCU, watershed, or viewshed; and (2) the stand level, which addresses individual harvest units. Some concepts to be considered at the landscape level may include maintaining large tracts of undisturbed old growth by concentrating timber harvest in certain areas, minimizing the “edge effect”, and using beach fringe and stream buffers for corridors between old-growth blocks. At the stand level, a variety of tools can be used within both even-aged and uneven-aged silvicultural systems. These include looking for opportunities to retain small patches of uncut timber in harvest units and leaving snags in harvest units (where safety regulations allow). Under even-aged management, the four types of clearcutting (with reserve trees) as described above, can be used. Most uneven-aged silvicultural systems fit the concept of ecosystem management well.

Criteria for the Selection of Harvest Cutting Method

Introduction

Criteria for the selection of harvest cutting methods to be used on national forests in Alaska are provided in 36 CFR 219.27(b) and the Alaska Regional Guide (USFS November 1983). The selected method must meet all of the criteria, which are:

1. Capable of meeting special management and multiple-use objectives (36 CFR: Criteria 1 and 6, Regional Guide: Standard 2);
2. Permit control of vegetation to establish desired species composition, density, and rates of growth (36 CFR: Criteria 4 and 6);
3. Promote a stand structure and species composition which minimizes risks from solar radiation, disease, and windthrow (36 CFR: Criterion 4, Regional Guide: Standard 2);
4. Use available and acceptable logging methods (36 CFR: Criterion 4, Regional Guide: Standard 2);
5. Assure that lands can be adequately restocked (36 CFR: Criterion 2);
6. Be practical and economical in terms of transportation, harvesting, preparation, and administration of timber sales (36 CFR: Criterion 7, Regional Guide: Standard 2); and
7. Not be selected solely on the basis of greatest dollar return or highest output of timber, and not permanently reduce site productivity or impair conservation of water and soil resources (36 CFR: Criteria 3 and 5).

In addition to the applicable laws and regulations, on June 4, 1992, the Chief of the Forest Service issued national direction on reduced use of clearcutting (Robertson 1992). Clearcutting would be limited to areas where it is essential to meet forest plan objectives and involve one or more of the following circumstances:

1. To establish, enhance, or maintain habitat for threatened, endangered, or sensitive species;
2. To enhance wildlife habitat or water yield values, or to provide for recreation, scenic vistas, utility lines, road corridors, facility sites, reservoirs, or similar developments;
3. To rehabilitate lands adversely impacted by events such as fires, windstorms, or insect or disease infestations;
4. To preclude or minimize the occurrence of potentially adverse impacts or insect or disease infestations, windthrow, logging damage, or other factors affecting forest health;
5. To provide for the establishment and growth of desired trees or vegetative species that are shade intolerant;

6. To rehabilitate poorly stocked stands due to past management practices or natural events; and

7. To meet research needs.

Rationale for Selection of Harvest Cutting Methods

Both even-aged and uneven-aged harvest cutting methods are available for selection within the suitable productive forest lands. Factors other than the silvicultural or ecological limitations of the species weigh heavily in the choice between uneven and even-aged management and among the several silvicultural systems that can be used to create even-age stands. These include: economic considerations, other resource values, terrain considerations with its limitations on logging systems, and other operational environmental considerations such as the presence or absence of dwarf mistletoe, susceptibility to windthrow, and susceptibility to logging damage.

The first step in the selection of an appropriate silvicultural system for an individual site is the diagnosis or range of acceptable treatments including a deferred (no action, Alternative 1) entry. An acceptable treatment is one that is feasible and has a reasonable expectation of achieving sound silvicultural objectives. Silvicultural objectives typically include species composition, stand condition class, growth rate, density, insect and disease control, and stand development over time.

The next step is to use the Forest Plan, management concerns, and public issues to determine the objectives for the site, then select the silvicultural system that best meets the objectives. In order to meet the issues and concerns reflected in the various alternatives, one or more silvicultural systems may be selected for the same site, depending upon the alternative.

In Southeast Alaska, the range in silvicultural options is limited by numerous factors, but the most dominant is the risk of windthrow. Areas of high windthrow risk offer the option to defer entry or to clearcut. Other forms of regeneration harvest have little or no probability of success where long-term timber production is at least one of the objectives for the site. The one exception to the above statement is where cedar forms a significant component of the stand structure. Because of the extensive top kill caused by cedar decline, the tops of these trees pose little resistance to the wind and are, therefore, relatively windfirm. This is especially true at higher elevations where the soils are frozen rather than saturated during the winter months when the majority of gale-force winds occur (see Table ST-6).

Areas of moderate-to-low windthrow risk have a wider range of reconnaissance options available. Uneven-aged reconnaissance systems are also being prescribed in these areas in an effort to develop alternatives to clearcut regeneration methods. Clearcutting is generally selected for these areas for the following reasons:

1. It is the most effective means of controlling dwarf mistletoe. The removal of infected trees interrupts the lifecycle of dwarf mistletoe and reduces the chance for infestation of the future stand. (36 CFR:Criterion 4, Regional Guide: Standard 2, Chief's Policy Letter: Criterion 4)

2. It lowers the risk of blowdown in the residual stands. The potential for windthrow increases along cutting boundaries but can be reduced through proper design of cutting units. (36 CFR: Criterion 4, Regional Guide: Standard 2, Chief's Policy Letter: Criterion 4)

3. It eliminates the risk of stand damage to the residual stand. The spruce-hemlock stands are composed of large trees and require large pieces of logging equipment which can cause significant damage to the residual stand. Spruce and hemlock tend to be shallow rooted, and therefore, susceptible to damage from ground based systems; clearcutting reduces these risks. (36 CFR: Criterion 4, Regional Guide: Standard 2, Chief's Policy Letter: Criterion 4)

4. It favors spruce and cedar. The logging operation will destroy some of the advance hemlock regeneration and thus take away its initial advantage. The increased sunlight also favors the spruce. (36 CFR: Criteria 4 and 6, Chief's Policy Letter: Criterion 5)

5. It can improve productivity. The cold air temperature and soil temperature do not favor decomposition of the organic forest floor. Exposing the site by clearcutting raises temperatures, which speeds the decomposition of raw humus and recycling of nutrients, particularly nitrogen. (36 CFR: Criterion 5, Chief's Policy Letter: Criterion 5)

6. It requires less road development. Less road construction is needed to remove a given amount of timber. Clearcuts favor longer spans which also allows for increased spacing between roads. (36 CFR: Criterion 5)

7. It is less costly. Fixed costs are spread over large volumes per acre and logging and road building is more concentrated. (36 CFR: Criterion 3 and 5, Regional Guide}

8. Natural regeneration is generally adequate. Experience with clearcutting since the 1950s, has shown that, except for certain situations, attaining natural regeneration is not a serious problem in the project area. Natural regeneration is abundant and generally averages 3,000 to 5,000 stems per acre 10 years after harvest. Competition among seedlings for growing space and nutrients results in reduced growth rates at about age 15 to 20. Stocking control is intended to increase the rate of diameter growth of the remaining trees; tree size has a significant impact on log values, improves crown ratios, favors commercially valuable trees (spruce), favors species (forage) or age classes which are most valuable for wildlife, windfirmness may be increased with early thinnings, or achieve other multiple-use objectives. (36 CFR: Criterion 2, Chiefs Policy Letter: Criterion 4 & 5)

Those units that are prescribed for other than even-aged management, have one of several objectives in mind: (1) structural diversity may be considered for a unit or landscape area. An example would be in wildlife corridors where a certain stand structure would be maintained; (2) another objective would be to attempt regeneration methods other than clearcutting to test whether they are feasible in lessor windthrow-risk areas of Southeast Alaska; (3) in areas where resource protection would be more difficult to achieve under even-aged methods, a lessor resource impact may occur where helicopter yarding could be used with a partial cut or group selection methods; or (4) in LUD III areas, uneven-aged methods could be used to maintain or enhance values other than timber resource values such as creating horizontal and/or vertical diversity in lower volume areas.

In addition, other forms of even-aged regeneration methods may be used. Seed cuts with cedar seed trees could be used to maintain the cedar percentage in the regenerated stand.

The seed cut is followed (usually 10 to 20 years later) by an overstory removal that removes the trees left as seed and shelter during the first entry. Economically this second entry may not be feasible. The few remaining standing trees could be used for wildlife snag recruitment. The purpose of this prescription is to respond to an issue raised during public scoping and an internal concern that following clearcutting, natural regeneration of yellowcedar is generally lacking.

The yellowcedar sites will regenerate naturally if clearcut, but the species composition is primarily western hemlock, mountain hemlock, Sitka spruce or western redcedar, depending upon the elevation. Yellowcedar will usually not be represented and must be planted to re-establish the species. Sites that are clearcut harvested using a helicopter would require a helicopter to move people and planting stock to and from the unit. The quality or grade of yellowcedar declines with increasing elevation. At lower elevations, sawlog quality cedar is of the highest value, while at higher elevations, yellowcedar is primarily utility grade. Helicopter logging of utility grade yellowcedar followed by expensive artificial regeneration efforts make it more expensive to retain the yellowcedar on high elevation, helicopter logging sites.

Table ST-5 displays the approximate acreage of identified partial removal or seed tree cut opportunities for this project by VCU and alternative. The only forms of partial cutting being attempted are shelterwood harvest, in which the trees below a specified diameter will be retained on the site to provide seed and shelter for a future crop of trees, or group selections, which are small cuts of only a few acres in size. These small cuts are spread across a cutting unit. Future entries would continue this cutting practice until the entire stand is regenerated over the course of the rotation. Alternative 1, the no-action alternative, proposes no harvest activities and is not displayed. Refer to Appendix J, Unit Design Cards, for a specific description of the silvicultural system recommended for each harvest unit.

Table ST-5
Preliminary Acreage of Partial or Seed Tree Cut Opportunities Identified for the Project by VCU and Alternative

	Alternative				
VCU	**2**	**3**	**4**	**5**	**6**
674	0	0	0	0	0
677	0	0	0	0	33
678	0	0	0	0	25
679	269	261	340	317	363
680	0	0	0	0	25
681	258	84	258	0	84
682	0	0	0	0	0
Total	**527**	**345**	**598**	**317**	**530**

SOURCE: USDA-Forest Service, Ketchikan Area GIS, Silviculture Coverage.

Silvicultural systems other than clearcutting have not been applied on a large-scale basis in Southeast Alaska. The anticipated results are based primarily on research and experience from other parts of the country. Because of the experimental nature of these proposed harvest systems, each unit is considered to be a clearcut for the purposes of analyzing the direct effects on the visual and wildlife resources. Partial cuts will be analyzed by field review between the draft and final impact statements.

The variety of clearcutting options that would be employed to enhance wildlife and visual values associated with clearcutting are shown in the Silvicultural System section in this section. These are basically clearcuts with reserves and vary with yarding method and logging feasibility.

Factors Influencing the Choice of Silvicultural Systems

The choice of silvicultural systems will depend on the silvical characteristics—that is, the reproductive habits and growth requirements—of the tree species, the operational environment (physical and biological setting), the management objectives that are to be achieved, and the operational feasibility of all logging systems (e.g., highlead, skyline, tractor, helicopter, etc.).

Silvical Characteristics—Commercial Species

Sitka Spruce

Sitka spruce (*Picea sitchensis*) is the largest and one of the most valuable trees—both biologically and economically. This species is classified as intermediate in tolerance ("tolerance" is defined as the ability to grow and prosper in the understory; light, moisture, or other environmental variables may be the limiting factor) and demands more light than its associate western hemlock (Harris and Farr 1974). Sitka spruce is a prolific seed producer with large crops every 2 to 3 years. Advance regeneration is prevalent in old-growth stands in Southeast Alaska. It produces small seed that can be carried long distances. Sitka spruce seed will germinate on almost any kind of seedbed if moisture is abundant. Natural regeneration can, consequently, be obtained through various reproduction methods.

Establishment is best on mineral soil with organic matter and with side shade and overhead light. Spruce has an advantage over hemlock on bare soil. The percentage of spruce reproduction often can be increased by clearcutting and exposing more mineral soil during the logging operation (Fowells 1965). The rooting characteristics of Sitka spruce show great variability, but in Southeast Alaska, the species tends to be shallow rooted. Consequently, the species is vulnerable to compaction and blowdown. The bark is relatively thin which makes it susceptible to logging injury and subsequent decay. Windthrow is the most serious damaging agent to Sitka spruce.

Western Hemlock

Western hemlock (*Tsuga heterophylla*) is also a major component of the Tongass National Forest. Western hemlock is classified as very tolerant and dominates the reproduction of the old-growth forests (Fowell 1965), which makes it an ideal species for management that includes partial cutting. Other associated conifers include western redcedar, Alaska yellowcedar, shore pine, lodgepole pine, Pacific silver fir, subalpine fir, and mountain hemlock. Western hemlock is a prolific seed producer. It produces seed almost every year, with heavy crops every 5 to 8 years; the seed is small and can be carried long distances in strong winds. The species can thrive on a wide variety of seedbeds; consequently, natural reproduction can be obtained through various reproduction methods from single tree to clearcutting. Most stands contain advanced regeneration and are often adequately stocked or overstocked. Hemlock does not develop a taproot and is a shallow-rooted species, thus is susceptible to windthrow. Most of the roots, particularly the fine roots, are near the surface and are susceptible to damage from compaction. Like spruce, this species also has thin bark and is susceptible to logging injury and subsequent decay.

Western Redcedar

Western redcedar (*Thuja plicata*) is an important tree species both economically and from a cultural perspective as well. Southeast Alaska Natives use this species for totem poles, clan houses, canoes, etc., because of its straight grain, size, lightweight, and workable texture. The stringy bark was used for making mats, baskets, and ropes. Western redcedar is commonly found in association with Alaska yellowcedar, western hemlock, lodgepole pine, and Sitka spruce.

Western redcedar is less tolerant than western hemlock and Sitka spruce. Western redcedar is a prodigious seed producer, but because of the small surface area of the seed wing, the seed does not travel far from the source. Although the germination percentage is often quite good, the seedling mortality rates are usually quite high, particularly when exposed to full

light. A light shade favors seedling development. Western redcedar is near the northern edge of its range in the project area and is typically found on poorly drained organic soils in combination with Alaska yellowcedar, lodgepole pine, western hemlock, and Sitka spruce. It is rarely found in pure stands. The best growth is achieved on better sites, where it forms a minor component of the stand with hemlock and spruce dominating. Regeneration is best established on sites that have exposed mineral soil and full light. Like most cedars, the tree is long lived and highly resistant to insect and disease attacks. The shallow water table on most organic soils makes western redcedar susceptible to windthrow. It is considered less windfirm than either spruce or hemlock and is used only as a last resort for either tailholds or guyline anchors.

Alaska Yellowcedar

Alaska yellowcedar (*Chamaecyparis nootkatensis*) is a minor, but valuable, commercial tree species found within the project area. At lower elevations it is commonly found on poorly drained organic soils in association with western redcedar, western hemlock, lodgepole pine, and Sitka spruce. At elevations above 1,000 to 1,500 feet western redcedar is no longer a stand component and mountain hemlock replaces western hemlock. At elevations above 1,200 to 1,500 feet Alaska yellowcedar may only be of firewood quality. Good cone crops are irregular, occurring only one out of every 4 to 7 years. The seed is heavy and will disperse 132 to 264 feet (2 to 4 chains). Alaska yellowcedar is classified as an intolerant species like western redcedar, and as such, it is less shade tolerant than hemlock or spruce. Growth is generally slow. Alaska yellowcedar is especially susceptible to winter drying where warm, sunny weather, in combination with frozen soils, causes top kill. Warm weather in the winter of 1956 resulted in extensive top kill that is still evident today. Yellowcedar decline is another problem (possibly the same as winter drying) that is resulting in dead tops and mortality. The upper third of the crown is the most productive for cone production and seed viability. The harvesting of old-growth cedar forests through large clearcuts has resulted in regeneration to other species. Whether this is due to the periodicity of the seed crops, the heavy seed with limited dispersal distance, cedar decline, or some other cause, is not known. Artificial regeneration or some form of partial cutting may be needed to ensure the continued presence of yellowcedar. Alaska yellowcedar is not particularly windfirm, but trees with dead tops provide much less resistance to the wind and may therefore be more windfirm.

Silvical Characteristics — Noncommercial Species

Pacific Yew

Pacific yew (*Taxus brevifolia nutt.*) is a small tree or shrub that is scattered on the eastern end the project area. Pacific yew is at the very northernmost portion of its range. It is typically found within 500 feet of saltwater as it depends upon the warm maritime climate to exist at this latitude. The bark from Pacific yew is high in taxol, which has been shown to have medicinal value for the treatment of cancer. The bark from Pacific yew trees located across the country is currently being tested for its taxol content. Cancer treatments are currently using taxol on an experimental basis. Due to the scattered nature of Pacific yew trees, it is envisioned that plantations will be developed from the seeds of trees that have the highest taxol content in order for the medicine to be affordable. Pharmaceutical companies are currently attempting to develop a synthetic version of taxol.

Pacific yew is not considered as having any commercial timber value. It is very tolerant to shade and requires it for establishment (Pacific Yew Act 1992).

An inventory of Pacific Yew was conducted on the project area in 1992 by Tom DeMeo. The study concluded that tree populations were very low, with an estimated six trees per mile of shoreline.

Most sitings on the project area have been on very low sites or within 500 feet of the shoreline. It is anticipated that project treatments would have little impact on Pacific Yew.

Alder

Both red and Sitka alder (*Alnus species*) are found throughout the project area. Sitka alder tends to be shrublike in form, with multiple stems, and rarely exceeds 30 feet in height. In contrast, red alder usually has a single, well-defined stem and can reach heights of up to 50 feet in the project area. Alder is commonly found along beaches and streams, and on avalanche tracks and landslide chutes. Alders are also common on roadsides, landings, and wherever soil has been highly disturbed. Alder is a primary succession species (one of the first to recolonize highly disturbed sites) and is usually shaded out 40 to 50 years after first being overtopped by Sitka spruce. Red alder is rarely found above 1,000 feet in elevation, but Sitka alder may grow above 2,500 feet in the project area. Alder seed is extremely light and can be spread great distances by the wind. A mineral soil seedbed is required and both species of alder are extremely shade intolerant. During its maximum growing period, alder can achieve 5 feet of height per year. Both species have the ability to fix nitrogen from the air. Because of this ability to fix nitrogen, and from abundant leaf fall which adds needed humus, alder is important for stabilizing or improving disturbed forest soils. Mixed stands of Sitka spruce and alder can be very productive. Red alder is used for smoking fish and for carving, but neither species is used commercially.

Operational Environment Climate

The forest has a maritime climate with abundant moisture throughout the year and has relatively mild winter temperatures and cool summers. Lack of a pronounced drought is probably the most important factor in affecting vegetation. The combination of warm water from the Japanese currents and prevailing westerly onshore winds result in cool, humid conditions throughout the project area. The weather patterns of Southeast Alaska develop strong wind patterns and winter storms tend to be very intense. Gale force winds may occur during any month, however, the strongest winds are most likely to occur in fall and winter months. The strong winds are usually accompanied by rainfall and saturated soils that contribute to blowdown.

The management implications are: (1) moisture is not a limiting factor in tree regeneration; (2) wildfire is not a major problem; (3) high winds can cause heavy losses of timber by windthrow; (4) the relative risk of windthrow limits the range of silvicultural options available to meet the management objectives for a given site; and (5) the strong fall winds favor natural regeneration.

The rooting habits of western hemlock and Sitka spruce make these species susceptible to windthrow; both species are shallow rooted and depend on mutual support for wind resistance. Western hemlock does not develop a tap root. In addition, both species have thin bark, which makes them susceptible to logging damage to the tree bole and subsequent wood decay. Trees with stem or root rots are more susceptible to damage from the wind. Wind is a major disturbance factor in Southeast Alaska, altering the structure of the forest. Scattered windthrow of large overmature trees is a prime cause of mortality and it creates small openings in which the advance growth in the understory may develop (group selection

would mimic this effect). Spruce is able to maintain itself as a stand component because of these small openings created by windthrow. Stands covering many acres can also be blown down and many existing young-growth stands originated following the blowdown of the previous stand. This windthrow plays a major role in determining the structure of the old-growth forests in Southeast Alaska. The resulting diversity has impacts on fish and wildlife populations.

Undisturbed forest watersheds are generally less likely to suffer windthrow damage than watersheds in which harvesting has taken place. Undisturbed timber stands have reached a certain degree of wind stability and tend to rely on each other to keep the main force of the wind above the forest canopy. However, once the stand structure is altered through harvesting or natural factors, wind is able to exert its full force against an edge of the stand and the stand becomes more susceptible to damage. Although there are probably no stands that are immune from windthrow damage, some are more susceptible than others. Although forest managers probably will never be able to eliminate wind damage completely, much can be done to reduce or minimize damage (Harris 1989). An important consideration in the planning process is what the effect of harvesting a particular unit will have on the windfirmness of adjacent stands. Common traits of windfirm stands and windthrow-susceptible stands have been documented by (Harris 1989). There are outlined in Table ST-6.

Topographic features also influence windthrow probability. The following features may result in decreased windfirmness:

- Westerly or easterly aspects where storm winds are accelerated around ridges;
- Southerly aspects exposed to onshore winds;
- Sideslopes or flats parallel to water channels oriented in a general northwest-southeast direction, especially along the west side of channels-flats and valley bottoms of heads of inlets or bays exposed to southerly winds;
- Small islands, promontories, or slopes at constrictions of channels with open water to windward; and
- Low ridges or upper leeward slopes.

A windthrow risk-rating system based on aspect (topography), existing blowdown (history), stand density (stocking), and other factors (defect, topography, etc.), was applied during field reconnaissance on harvest units in the project area. During the timber stand examination and walk through, information was gathered to rate potential harvest units as high or low windthrow risks. These ratings are documented in the silvicultural prescriptions developed for each harvest unit. Of rated potential harvest units, 60 percent were given a high windthrow-risk rating and 40 percent were given a lower rating.

Table ST-6
Traits of Windfirm Stands and Traits of Stands Susceptible to Windthrow

Trait	Windfirm Stands	Susceptible Stands
Age	Young	Old
Age Structure	Even-aged	Uneven-aged
Defect	Little defect	Large amounts of defect
Height	Short	Tall
Stocking	Open stocking on less productive sites, muskeg or scrub stands	Dense stocking on productive sites
Species Composition	Have a high percentage of cedar and hardwoods	Predominately spruce and hemlock
History	Intact with little evidence of recent openings	Previously damaged by blowdown
		Even-aged pole or young sawtimber opened by thinning or partial cutting

SOURCE: Wind in the Forests of Southeast Alaska and Guides for Reducing Damage, A.S. Harris, PNW-GTR-244.

Silviculture: Effects of the Alternatives

Size of Harvest Units

The National Forest Management Act of 1976 (NFMA) specifies a limit on the size of forest opening which may be created based on the forest type. For the western hemlock/Sitka spruce forest type associated with Southeast Alaska, this maximum opening size is 100 acres. The NFMA provides leeway for extending this opening size to 150 acres under certain conditions (e.g., timber economics, regeneration requirements, wildlife or fisheries habitat needs, transportation or harvest system requirements, etc.) and for exceeding 200 acres under extreme circumstances (major insect and disease outbreak, fire, windthrow, or other form of catastrophic damage).

Most of the action alternatives propose several harvest units which exceed 100 acres. All harvest units are under 150 acres. Table ST-7 summarizes the number of units proposed by each alternative which exceed 100 acres. Since Alternative 1 does not propose any timber harvest at this time and no acres would be cut, it is not displayed.

Table ST-7
Number of Units Exceeding 100 Acres & Range of Harvest Unit Size

Alt.	Total # of Units\Alt.	Number Exceeding 100 Acres	Exceeding NFMA Size Requirements (Acres)
2	33	1	110
3	56	1	110
4	74	2	110
5	64	0	
6	124	2	110

SOURCE: USDA-Forest Service, Ketchikan Area GIS, LSTA Layer.

A detailed list of the individual units exceeding 100 acres, along with the reason for their inclusion, is shown in Appendix B.

Proposed Harvest by Site Class

Because some site classes are more productive than others, they are rated by a site index and are assigned a class of low, medium, or high. The site index is based on the expected height to which a tree will grow on that site within a given number of years (in this case, 50 years). On low sites, trees would be expected to grow between 45 and 56 feet in height in 50 years. On medium sites, trees would be expected to grow between 57 and 66 feet in height in 50 years, and on high sites, trees would be expected to grow more than 77 feet high in 50 years. In general, more timber can be grown at less cost on a high site than on a medium or low site, and more timber can be grown at less cost on a medium site than on a low site (Davis 1966). However, by mixing high, medium, and low sites, average logging costs for low sites can be reduced and more land is available for timber management over the rotation.

Table ST-8 displays the acres of proposed harvest for each alternative by site class.

Table ST-8
Acres of Proposed Harvest by Site Class (Productivity)

	Unclassified (0)		Low (2)		Medium (3)		High (4)		Total	
Alt.	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
2	126	11	132	12	456	39	446	38	**1,160**	**100**
3	128	7	173	9	960	50	639	34	**1,900**	**100**
4	435	15	60	2	1,084	38	1,277	45	**2,856**	**100**
5	358	16	132	6	953	42	815	36	**2,257**	**100**
6	519	12	218	5	1,638	39	1,826	44	**4,201**	**100**

SOURCE: USDA-Forest Service, Ketchikan Area GIS, CLU data layer.

Alternative 6 proposes to bring the highest number of acres in medium and high site classes under management (3,464 acres or 83 percent of the acres proposed for harvest). Alternative 4 proposes to bring the second highest number of acres in medium and high-site classes under management (2,361 acres or 83 percent of the acres proposed for harvest), followed by Alternative 5 (1,768 acres or 78 percent of the acres proposed for harvest), Alternative 3 (1,599 acres or 84 percent of the acres proposed for harvest) and Alternative 2 (902 acres or 77 percent of the acres proposed for harvest). Alternative 1 proposes no timber harvest at this time and therefore does not provide an opportunity to bring medium and high sites under management.

Indirect and Cumulative Effects

Regeneration

All of the areas proposed for timber harvest will be restocked within 5 years as required under the National Forest Management Act of 1976 (NFMA). A combination of natural regeneration (vast majority) and artificial regeneration (tree planting) could be utilized to restock harvested areas. Prescribed fire for site preparation is not being proposed for any of the alternatives.

Harvested sites must contain a minimum of 300 well dispersed trees per acre by the fifth year following harvest to be considered successfully regenerated. Survival (staked tree) surveys will be conducted on all planted sites the first and third full growing seasons after being planted. Regeneration (stocking) surveys must be conducted on all harvest units the third and fifth full growing season after yarding is complete. The third year survey is used to determine whether, if any, additional reforestation efforts are required. The fifth year survey is used primarily to certify that the regeneration process has been successful. Table ST-9 shows the acres of essential reforestation treatments to be performed by alternative. It should be recognized that areas requiring artificial regeneration cannot be accurately identified until after harvest when the third year stocking surveys indicate inadequate natural regeneration. Thus, these acreage figures may change at the time planting would occur.

Table ST-9
Anticipated Essential Reforestation Treatments (by Alternative) in Acres

Alt.	Clearcut Natural Regeneration Surveys at 3 & 5 Years	Partial Cut Regeneration Surveys at Year 3	Plantation Stocking Surveys 1 & 3 Years	Prescribed Tree Planting
1	0	0	0	0
2	635	527	73	73
3	1,555	345	177	177
4	2,285	598	215	215
5	1,933	317	226	226
6	3,660	530	332	332

SOURCE: USDA-Forest Service, Craig Ranger District Silviculture Report.

Long-term Timber Productivity (Yield)

The effects of all action alternatives on long-term yield would be the conversion of unmanaged, slow-growing, overmature stands to managed, faster growing, early seral, even-aged stands. Overmature stands have lower forest floor temperatures than even-aged stands; thus reducing biological activity. Organic decomposition slows, and as a result, the supply of available nutrients is reduced. With decreased biological activity, less nitrogen is available for tree growth and nutritional status is lowered. While overmature stand growth and vigor remain nearly constant, they are at a level below that of young even-aged stands (Harris et al. 1974). Table ST-10 displays the average structural characteristics of managed stands by site classification (low, medium, and high).

The magnitude of the effect of converting unmanaged, overmature stands to managed, even-age stands will vary depending upon the number of acres harvested in each site class. Alternative 6 converts the most acres to managed condition (4,190 acres), followed by Alternative 4 (2,883 acres), Alternative 5 (2,250 acres), Alternative 3 (1,900 acres), and Alternative 2 (1,154 acres). Alternative 1 proposes no timber harvest and will not convert any stands to a managed condition.

All stands proposed for harvest are overmature and well beyond the age of maximum average annual growth of the stand. They are representative of uneven-aged western hemlock stands that commonly take hundreds of years to develop under natural conditions (unless they are changed by natural events such as windthrow).

The open conditions created by clearcutting allow both Sitka spruce and western hemlock to regenerate rapidly. Even-aged stands are generally comprised of 10 to 75 percent spruce, depending on the soil type and age of the stand. On average, the volume of spruce in even-aged stands 75 to 100 years after harvest is about 50 percent (Taylor 1934) compared to 28 percent in existing overmature stands. With the use of precommercial thinning, an additional 10-20 percent increase in the spruce component is attained.

Although log quality in second-growth stands is expected to be lower than in existing overmature stands, even on sites that have been precommercially thinned, total yield per acre will be higher in second-growth stands. The lower quality will be reflected in the log grades, with second-growth timber stands having fewer top grade logs than existing overmature stands. In addition, second-growth stands will have less volume in the larger diameter classes. Nevertheless, total yield will be significantly greater in second-growth stands than in over-mature stands. The long-term result of precommercial thinning is more useable wood fiber. Precommercial thinning also allows the option of reducing the economic rotation age. This is because merchantable size logs are produced at an earlier age if the site is thinned.

Most second-growth even-aged stands will exhibit less variation in tree diameter and height than the overmature stands they replace. At 100 years of age, average diameters for unmanaged second-growth stands will range from 13 inches on medium sites to 15 inches on high sites. With precommercial thinning, it is possible to produce average stand diameters that approximate old-growth averages. At age 100, diameters can range from 16 inches on medium sites to more than 18 inches on high sites (Forest Service 1990a).

Table ST-10
Average Structural Characteristics of Managed Stands (by Site Classification)

Stand Age (years)	Height (feet)	dbh (inches)*	Volume/Acre (board feet)**
Low Site			
5-20	26	1.4	0
20-50	56	4.9	1,900
50-80	82	8.5	14,100
80-100	96	10.8	25,500
100-120	107	12.8	37,100
120-160	122	16.4	56,800
Medium Site			
5-20	29	3.5	0
20-50	66	9.8	7,400
50-80	98	13.6	29800
80-100	114	15.37	46,100
100-120	126	17.8	61,400
120-160	144	21.3	81,900
High Site			
5-20	31	4.0	100
20-50	77	11.0	13,900
50-80	111	15.2	43,400
80-100	127	17.5	62,400
100-120	139	20.1	78,000
120-160	157	24.1	100,300

Source: USDA-Forest Service 1991

* Diameter at breast height
** Net Sawlog

Precommercial Thinning

Regeneration of naturally disturbed or harvested areas may result in stocking levels of seedlings/saplings on many upland sites with an average of 4,000 stems per acre. Although these stands will eventually thin naturally, production of useable wood fiber would be hastened if stocking were less dense through the use of precommercial thinning (Harris and Farr 1974). Growth and yield models indicate that for every acre precommercially thinned, timber yield increases by 6.9 MBF on medium and 8.9 MBF on high sites, over a 100-year rotation. Precommercial thinning reduces the competition for sunlight, moisture, and nutrients for what is often referred to as growing space. This additional growing space results in the understory plants and remaining conifers growing at accelerated rates for longer time periods than unthinned, second-growth stands. Precommercial thinning can also be used to change species composition and windfirmness of the stand. Cedar and spruce will be favored during the thinning process. Where necessary, release (felling submerchantable whips infected with dwarf mistletoe) will occur at the same time as the precommercial thinning to prevent the re-infection of the new crop of trees. It should be recognized that precommercial thinning is performed approximately 15-20 years after harvest and is dependent upon site, stocking, and other resource needs. Table ST-11 shows the number of acres that have been identified for potential precommercial thinning in the future by alternative.

Recent trends in forestry have moved toward lower density/wider-spaced stands. With wider spacing, more light can penetrate to the forest floor for shrub and herb development, providing wildlife forage. As stands develop, they reach the stand exclusion stage where tree density blocks light to the floor. This "stem exclusion stage" provides thermal and hiding cover, but provides little browse opportunities. Thinning before canopy closure would promote understory growth, enhance biodiversity, and increase diameter growth. However, at the winder spacings, lower branches receive more light and become larger and more persistent.

The timing of precommercial thinning will be determined by the quality or productivity of the site, the limitations of terrain, and accessibility. In lower quality sites, where trees take longer to express dominance in height characteristics, precommercial thinning is planned between 20-25 years after harvest. On highly productive sites where competition slows growth earlier, the best payoff for thinning occurs when the treatment occurs between 15-20 years after harvest. The Southeast Alaska Prognosis (SEAPROG) model runs show that thinning to 12 by 12 spacing yielded the greatest volume increase, 9 percent over no thinning, and ranged to a 9 percent loss in volume for 18 by 18 foot spacing. Table ST-11 shows the number of acres that have been identified for potential precommercial thinning in the future by alternative.

Due to steep terrain, accessibility, safety considerations, resource protection needs, and budget constraints, some acres will not be thinned. Areas of extreme slopes will be left unthinned for reasons of soil protection, high costs, and safety considerations. High elevation stands, usually containing a mix of mountain hemlock and yellowcedar, will generally have silvicultural treatments retaining mature seed sources, resulting in an uneven-aged stand where precommercial thinning would not be necessary. Restocking of these high elevation sites tends to be sparse, also delaying the need for thinning, and possibly requiring an extended rotation. Some of the high elevation sites having access may be precommercially thinned at greater than 25 years of age.

Pruning
Pruning can be used to improve wood quality and increase value by minimizing the defect core and maximizing the clear wood. Occlusion (healing over with clear wood) is rapid when pruning is accomplished early in the rotation when branches are small and bark is thin. Pruning can also be used to improve aesthetics, increase microbial activity, nutrient recycling, and stimulate the growth of understory vegetation for wildlife forage. Pruning of second-growth stands may be an optional strategy in the future, assuming it can be made to be cost effective.

Commercial Thinning
Some commercial thinning has been done on the Tongass National Forest in the past, although not on a widespread basis. It is expensive to perform commercial thinning with cable yarding systems. Currently the economics of commercial thinning in Southeast Alaska are marginal due to the limited demand for small diameter logs and logging expense.

The Silviculture Diagnosis
Appendix H presents a detailed listing of the sites by alternative where precommercial thinning is proposed when the stand reaches 15 years old.

Table ST-11
Precommercial Thinning and Release (Acres by Alternative)

Alternative	Release	Potential PCT 15-20 Years after Harvest High Sites	Potential PCT 20-25 Years after Harvest Moderate Sites	Potential PCT 25+ Years after Harvest Poor Sites
1	0	0	0	0
2	117	109	181	180
3	230	343	429	398
4	145	773	423	338
5	180	498	420	414
6	293	914	930	617

SOURCE: USDA-Forest Service, Ketchikan Area GIS, Chasina Silviculture Coverage.

Second-Growth Management for Other Resource Values

Fisheries Rehabilitation
A small percent of riparian management areas within the project area were harvested between 1954 and 1990. Most of this timber harvest occurred within recently designated buffers before any significant stream protection measures were implemented. As a result, several

Class I and Class II streams, that would receive a stream or beach buffers today, were harvested up to the bank.

Riparian management areas previously harvested for timber are now in various stages of secondary plant succession. Except where the ground was highly disturbed, the stand composition on the secondary successional riparian areas is similar to riparian vegetation prior to timber harvest, with Sitka spruce typically forming the canopy. On the more disturbed sites where mineral soil was exposed during timber harvest activities, the vegetation is often composed of early successional species, such as red alder and salmonberry.

Many studies have established the need for large woody debris (LWD) material in streams. It is an important component to bedload dynamics as well as providing structure, habitat, and nutrients. Existing riparian stands of extremely dense conifers or alder, for example, will require a long period of time (greater than 100 years) to develop large material for recruitment. Management of these existing riparian stands could produce the same size material for recruitment much sooner. On a high site index stand (most riparian sites are very productive), a precommercial thinning at age 15 (maintain growth rates and promote windfirmness), followed by a second precommercial/commercial thinning at age 40 to 50 (variable spaced thinning from below) could produce snags over 15 inches in diameter (USDA Technical Bulletin No. 544). This would also promote the initial development of a two-storied stand. The objective of this type of treatment would be to promote a multi-storied canopy layer over time, promote habitat for snag dependent wildlife, and as the snags fall over, begin to provide LWD to the streams much sooner than would occur naturally. A site-specific silvicultural prescription that incorporates the concepts listed above could be prepared if funding is available for fisheries rehabilitation work.

Wildlife Management

The structure and composition of second-growth stands are dramatically different than that of old growth. Second-growth management is not intended to mimic or replace the need for old growth (see Chapter 3, Biodiversity section). It is possible to achieve commodity production objectives in a way that lessens the negative impacts upon certain wildlife habitat needs through the application of ecosystem management principles. Most existing older second-growth stands are relatively small stands with beach access. These are dense, single-storied stands with little understory forage and few standing snags. The prevailing theory on second-growth management for wildlife would say that, in general, these stands are too old to thin for forage enhancement (over 25 years of age). However, uneven-aged management could be used to cut openings or enlarge existing openings for forage enhancement.

One key would be to enter second growth often enough (10-25 years) to insure that existing forage would not be entirely shaded out before treatment occurs. Variable spaced or more widely spaced precommercial thinning could help promote continuous forage.

A site-specific silvicultural prescription that incorporates these concepts would be prepared in coordination with a wildlife biologist prior to implementation, should funding be available. Due to the fact that most second-growth management prescriptions to promote other resource values are somewhat experimental, very few examples of managed older second growth exist, the potential benefits were not used in modeling future wildlife/fisheries or other resource values.

Plant Community Successional Stages Including Old Growth

After reforestation, managed forests grow through several distinctive successional stages which generally are applicable to all even-aged cutting units proposed for harvest under the action alternatives. Characteristics such as height, diameter, and productivity vary according to site class (discussed previously in this section). Different components dominate the stand at different stages, and the overall forest structure changes over time.

Managed forests progress through several distinctive successional stages.

Seedling/Sapling Stage

The first 20 years following harvest is referred to as the seedling-sapling understory colonization stage. During the first 5 years of this stage, the young stand receives maximum sunlight, resulting in the rapid establishment of a variety of shrubs, forbs, and grasses. There is little incidence of damage or mortality from disease or infestation at this stage. The changed structure of the young stand affects the structure of adjacent stands. Windthrow potential increases with greater wind exposure and understory development accelerates due to increased sunlight into the newly developing stand.

In years 5 to 20, seedlings grow into a vigorous new forest of trees, ranging from 20 to 30 feet in height and 1 to 8 inches diameter at breast height (dbh), depending on the advance regeneration present. Understory production of woody-stemmed species is at its highest at this stage, especially in blueberry dominated sites. Larger dead materials from the original stand begin to decompose, and the stand edge is stabilized - resulting in less windthrow to the adjacent stand. At the end of this successional stage, the stand can be considered for precommercial thinning, leaving a species composition of about 60 percent western hemlock,

40 percent Sitka spruce, and a small cedar component. Slightly higher spruce and cedar composition after thinning.

Table ST-12 tracks the cumulative acres in the seedling/sapling stage from the present condition, through implementation of each alternative, to the end of the long-term contract in 2004. The seedling/sapling stage on these high sites were stands cut after 1970. These figures represent the current condition and the changes that occur over time as the stands grow from one stage to the next. Alternative 6 projects the highest number of acres in the seedling/sapling stage (5,205 acres), followed by Alternative 4 (3,936 acres), Alternative 5 (3,478 acres), Alternative 3 (3,100 acres), and Alternative 2 (2,180 acres). Alternative 1, the No-Action alternative, projects the lowest number of acres in this successional stage.

Future harvest through 2004, will add to the acreage in this stage.

Table ST-12
Direct and Indirect Effects in Acres on the Seedling/Sapling State (by VCU and Alternative)*

	Alt. 1 (Existing Condition)		Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt. 6	
VCU	**1998**	**2004**	**1998**	**2004**	**1998**	**2004**	**1998**	**2004**	**1998**	**2004**	**1998**	**2004**
674	0	0	0	0	0	0	106	106	106	106	106	106
677	0	0	0	0	0	0	0	0	0	0	74	74
678	290	0	290	0	532	242	688	398	631	341	885	495
679	1,203	1,203	1,534	1,493	1,859	1,818	2,514	2,473	2,470	2,429	2,802	2,761
680	17	17	168	168	196	196	17	17	127	127	196	196
681	2	2	155	155	354	354	191	191	80	80	688	688
682	33	33	33	33	159	159	420	420	64	64	454	454
Total	**1,545**		**2,180**		**3,100**		**3,936**		**3,478**		**5,205**	

SOURCE: USDA-Forest Service, Ketchikan Area GIS database, SIS data layer.

* Does not include projected partial cut unit.

Pole/Young Sawtimber Stage

The next successional stage occurs during years 20 to 50 following harvest and is referred to as the understory exclusion stage. It is characterized by accelerated tree growth (approximately 1 foot per year) and a rapidly closing tree crown canopy. At age 50, tree heights range from 48 to 72 feet and diameters range from 5 to 10 inches, depending on the site class. Tree crowns begin to grow closer together, causing the understory to change from

a dense shrub, herb, and seedling-dominated structure to one of dense moss. Stands which have been precommercially thinned will have a two-layered canopy with western hemlock in the lower story. Canopy closure will occur more slowly in precommercially thinned sites. As any proposed harvest would probably not begin until 1998, and is expected to be completely offered by 1998, none of the units proposed for harvest at this time would grow into this successional stage by 2004. The only change that occurs is the growth of some of the existing harvest units into the understory exclusion stage. Several stands will continue to progress within the understory exclusion stage.

In years 50 to 80, the stand remains closed. At age 80, tree heights range from 74 to 107 feet and diameters range from 8 to 13 inches, depending on site class. Little sunlight reaches the forest floor, and the understory continues to be dominated by moss. Tree diameter growth slows to about 1 inch every 10 years, as competition between trees increases. It is not currently economically feasible to commercially thin trees at this stage, but thinning would increase growth and diversity of the shrub layer, as well as increase diameter growth of the remaining trees.

Table ST-13 tracks the cumulative acres in the pole/young sawtimber stage from the present condition, through implementation of each alternative, to the end of the long-term contract in 2004. These figures represent the current condition and the changes that occur over time as the stands grow from one stage to the next.

Table ST-13
Direct and Indirect Effects in Acres on the Pole/Young Sawtimber Stage by VCU and Alternative

VCU	Existing Condition (1996)	Alt. 1 1998	Alt. 2 1998	Alt. 3 1998	Alt. 4 1998	Alt. 5 1998	Alt. 6 1998
674	0	0	0	0	0	0	0
677	0	0	0	0	0	0	0
678	171	171	171	171	171	171	171
679	58	58	58	58	58	58	58
680	104	104	104	104	104	104	104
681	87	87	87	87	87	87	87
682	0	0	0	0	0	0	0

SOURCE: USDA-Forest Service, Ketchikan Area GIS database, SIS data layer.

As the proposed harvest would probably not begin until 1998, and is expected to be completely offered by the year 1998, none of the acres proposed for harvest in this entry

would grow into this successional stage by 2004. Likewise, none of the projected harvest through 2004 would have grown into this successional stage. The only change that occurs is the growth of some of the existing harvest units into the pole/young sawtimber stage. Thus each alternative shows the same number of acres in this successional stage after implementation and in 2004.

Mature Sawtimber Stage

In years 80 to 100 —the mature, even-aged forest and understory reinitiation stage —the stand becomes mature. At age 100, tree heights range from 88 to 123 feet and average stand diameters range from 10 to 18 inches, depending on site class. Some trees may die, while others become clearly dominant in size. Diameter growth remains at less than 1 inch every 10 years. Moss continues to dominate the understory, except in places where the canopy has opened and allowed sufficient light for herbaceous plants. These structural characteristics continue into the later stages of the stand (approximately 100 to 160 years) with continued slow growth and occasional openings in the canopy (Forest Service 1989b).

Old-growth Stage

The final successional stage for a forest is the old-growth stage, which would pertain to stands that are prescribed to be managed for old-growth conditions or stands that have been deferred for harvest. This stage is characterized by a multi-storied stand with a large over-mature overstory composed of live and dead trees and an understory of mostly shade-tolerant western hemlock. There would be a substantial component of downed large trees and occasional openings in the forest canopy. Patches of shrubs, tree saplings, and herbs alternate with patches of overmature timber, creating a complex, multi-layered mosaic. The stand declines in growth and has the highest degree of variation and most structurally diverse understory of any successional stage.

Table ST-14 presents the acres of commercial old growth that existed prior to the EIS implementation, the acres that are projected to remain following implementation of each alternative, and the acres of commercial old growth expected to remain at the end of the contract period (2004). It is assumed that all types of applied silvicultural systems result in a managed stand and therefore are subtracted from the old growth.

Table ST-14
Projected Acres of Remaining Commercial Old-Growth Sawtimber by VCU and Alternative

	Existing Condition	Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt. 6	
VCU	(1996)	1998	2004	1998	2004	1998	2004	1998	2004	1998	2004	1998	2004
674	1,403	1,403	1,403	1,403	1,403	1,403	1,403	1,403	1,403	1,297	1,297	1,296	1,296
677	911	911	911	911	911	911	911	911	911	911	911	804	804
678	5,512	5,512	5,512	5,512	5,212	5,270	5,270	5,114	5,114	5,171	5,171	4,892	4,892
679	8,429	8,429	8,429	7,829	7,829	7,512	7,512	6,778	6,778	6,845	6,845	6,467	6,467
680	1,587	1,587	1,587	1,436	1,436	1,408	1,408	1,587	1,587	1,477	1,477	1,383	1,383
681	3,883	3,883	3,883	3,472	3,472	3,447	3,447	3,436	3,436	3,805	3,805	3,113	3,113
682	2,453	2,453	2,453	2,453	2,453	2,327	2,327	2,066	2,066	2,422	2,422	2,032	2,032
Total	**24,178**	**24,178**		**23,016**		**22,716**		**21,295**		**21,928**		**19,987**	

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base and Craig Ranger District Silviculture Report.

The cumulative effects of harvesting old growth will result in the conversion of large areas to a mosaic of second-growth sites of differing age classes. By the year 2004, 83 to 100 percent of the existing commercial acres will remain after projected harvest under the alternatives. Alternative 6 leaves the least old growth with 83 percent remaining while Alternative 2 leaves the most of the action alternatives at 95 percent.

Timber: Affected Environment

Forest Classification

The 65,307 acres of land within the Chasina Project Area are defined by their ownership and vegetative cover. This land has been categorized as forest land, non-forest land, or other ownership.

Other Ownership

Other ownership refers to lands owned by private individuals, by the State of Alaska, or by Alaska Native corporations. About 32 percent (approximately 21,946 acres) of the project area is in other ownership.

Nonforested

Nonforested means National Forest System land that is biologically unable to support a cover of predominantly timbered vegetation. This includes muskeg, rock out-croppings, talus slopes, and water bodies, among others. About 10 percent (approximately 7,047 acres) of the project area falls into this category.

Forested

Forested land refers to National Forest System Land that consists largely of timbered vegetation and is further categorized as commercial forest land (CFL) or noncommercial forest land. About 37,431 acres, or 54 percent, of the project area falls into this category.

Noncommercial Forest Land

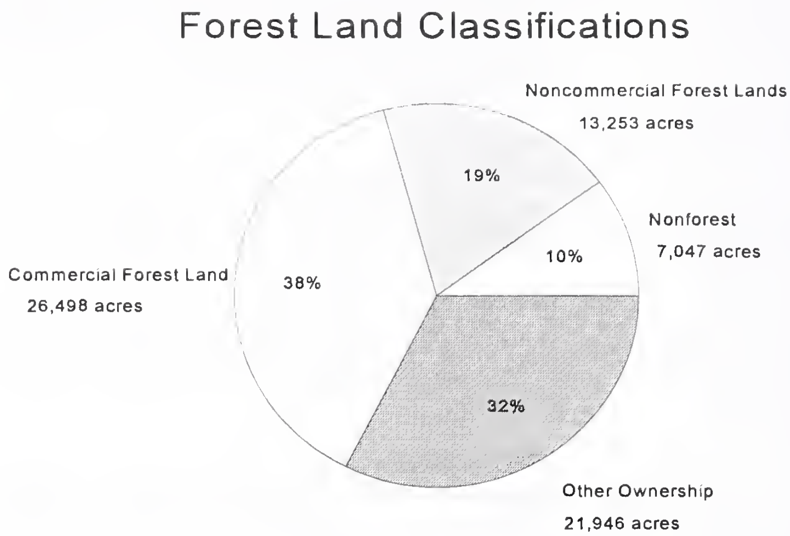
Noncommercial forest land does not support enough timber volume to meet the criteria for CFL. The project area forested land area contains about 19 percent (13,253 acres) of noncommercial forest land.

Commercial Forest Land

Commercial Forest Land (CFL) is capable of producing continuous crops of timber. The Forest Service has specified that each acre of CFL must be capable of producing 20 cubic feet of tree growth annually or must contain at least 8,000 board feet (MBF) of net timber volume (USDA Forest Service 1977a). Old-growth and second-growth stands (younger, even-aged stands that grew after the previous stand was harvested or destroyed by agents such as wind, fire, or insects) may qualify as CFL. The Chasina Project Area is composed of about 38 percent (26,498 acres) CFL.

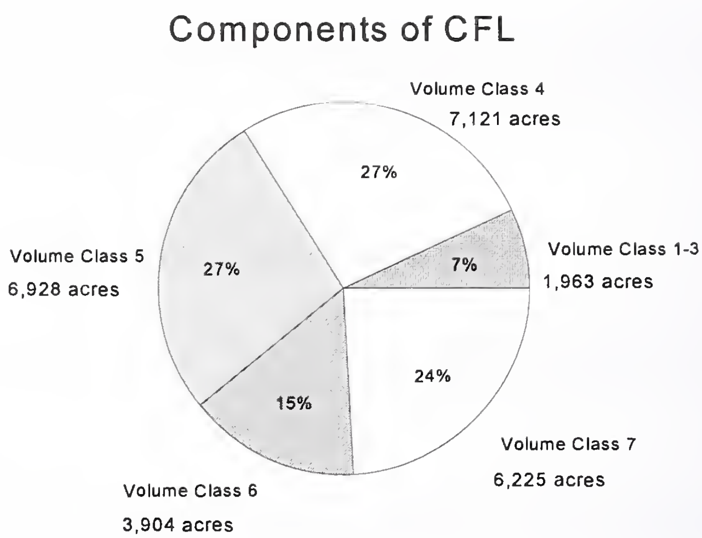
Figure ST-2 displays the breakdown of the various Forest Land Classifications within the project area, and Figure ST-3 identifies the components of the CFL.

Figure ST-2
Forest Land Classifications



SOURCE: USDA-Forest Service, Ketchikan Area, Data Base.

Figure ST-3
Components of CFL



SOURCE: USDA-Forest Service, Ketchikan Area, Data Base.

Tentatively Suitable Forest Lands

CFL is further defined as to its suitability undergoing review as identified in Appendix A of TLMP (1979, as amended), TLMP Draft Revision (1991a). To be considered Tentatively Suitable, the CFL must:

- be forested lands that have both the biological capability and availability to produce crops of industrial wood;
- not be developed for non-forest uses;
- be capable of harvest with available technology to ensure timber production without irreversible resource damage to soil productivity or watershed conditions;
- be capable of restocking within 5 years after final harvest;
- have adequate information available to project response to timber management practices; and
- have not been withdrawn legislatively from a timber production classification.

Suitable Forest Lands

Tentatively Suitable is further refined as Suitable Forest Lands. For the purposes of this analysis, all lands which have a Management Prescription or proposed Management Prescription that precludes timber harvest are eliminated from the tentatively suitable base. The remainder are classified as suitable.

To be considered suitable for harvest, these forested lands must have a LUD that allows commercial timber harvest (LUD Ill or LUD IV).

For this process, project area lands have also been deferred from the suitable base if they have a TLMP Draft Revision (1991a) LUD prescription that does not permit commercial timber harvest.

About 52.0 percent of the project area (approximately 20,300 acres) is non-CFL. This leaves approximately 26,498 acres of CFL. Lands withdrawn from the Tentatively Suitable, not contributing to the suitable base considered for this project, include lands allocated to Primitive Recreation (see Chapter 1), buffers mandated by the Tongass Timber Reform Act on certain fish-bearing streams, 100-foot buffers around all lakes greater than five acres in size, 500-foot buffers around the saltwater shoreline, 1,000-foot buffers around estuaries, and 330-foot buffers around all known eagle nests.

Table ST-15 displays the type and amount of adjustments made to the CFL, which lead to the suitable base.

Table ST-15
Adjustments to the CFL, Leading to Suitable Available Acreage

	VCU							
	674	677	678	679	680	681	682	Totals
CFL (acres)	1,403	1,148	6,250	9,482	1,713	3,936	2,565	**26,498**
Soils	(441.4)	(224.5)	(2,245.8)	(130.7)	-	(309.3)	(267)	**(3,619)**
Wilderness	-	-	-	-	-	-	-	-
TTRA/RP Zone	(142.3)	(243.7)	(538.5)	(743.6)	(353.9)	(477)	(161.3)	**(2,660)**
Previously Harvested	-	1.2	461.0	1,257.7	120.9	88.5	33.3	**1,963**
Estuary and Beach buffers	(86.5)	(387)	(1,273.1)	(2,106.1)	(685.4)	(1,000)	(745.6)	**(6,284)**
Eagle buffers			(9.3)	(0.9)		(1.9)		**(12)**
No Harvest Prescription	(2.7)	(94)	67.0	126.7	67.6	74.1	32.2	**(464.3)**
Available Suitable (acres)	730	198	1,655	5,116	485	1,986	1,326	**11,496**

SOURCE: USDA-Forest Service, GIS Data Base, based on TLMP Draft Revision (1991).

Suitable Base

Previous harvest within the project area has largely used clearcut logging methods. Previous timber harvests have occurred within the project area for the independent sale program. Previously harvested timber stands (second growth) were considered unavailable for timber harvest for this project analysis. About 7.4 percent of the CFL (approximately 1,963 acres) has been previously harvested from the Chasina Project Area excluding lands that have been conveyed.

Volume Class

CFL in the Tongass National Forest has been classified into different volume class ranges based on per acre volume estimates. In the mid-1970s, the Forest Service contracted an independent consulting firm to assign volume per acre for all lands on the Ketchikan Administrative Area. This inventory estimated timber and landform conditions based upon aerial photo interpretation. This volume per acre data was stratified into different volume classes which are used to describe the volume range of timber per acre in thousands of board feet (MBF).

Volume Class 3 is forested land which contains less than eight MBF per acre; examples include unstocked, recently harvested stands and fully stocked, immature stands. Volume Classes 4 through 7 contain trees of merchantable size and with more than 8 MBF per acre.

Table ST-16 displays the volume range for each volume class.

Table ST-16
Volume Range Within Volume Class Strata (Based on Timber Type Maps)

Volume Class Strata	Range of net sawlog volume (MBF/Acre)
4	8 - 20
5	20 - 30
6	30 - 50
7	>50

SOURCE: USDA-Forest Service, GIS Data Base

Volume Estimates

Stand inventory data contributing to the original volume per acre data, was composed of on-the-ground evaluations of stand characteristics and capabilities. For the DEIS, the Craig Ranger District contracted stand examination plots, supplementing the original stand inventory throughout the project area. These stand exam plots were randomly distributed throughout all of the initial LSTA identified harvest units (potential harvest unit pool). Unit pool field observations were also used to create the volume per acre figures displayed below.

Based on the above analysis and field recon, this data is relevant for project area estimations and is an adequate predictor of volume per acre by volume class. Table ST-17 displays the net volume per acre (including an estimation of utility volume) by volume class.

Table ST-17
Estimated Average Net Volume per Acre (Including Utility) by Volume Class

Volume Class			
4	5	6	7
17,113 BF/A	25,943 BF/A	40,000 BF/A	50,000 BF/A

SOURCE: USDA-Forest Service, Craig Ranger District Silviculture Report.

BF/A = board feet per acre

These volume per acre figures were used to calculate planned harvest unit volumes in the development of Table ST-18 and to develop mid-market calculations later in this section.

Effects of the Alternatives

Based on the TIM-Type layer in GIS, approximately 28 percent of the acres in the harvest units in the project area is Volume Class 4; 29 percent is Volume Class 5; 14 percent is in Volume Class 6 , and 29 identified in Volume Class 7.

Table ST-18
Proposed Harvest Volume by VCU and Alternative

	Total MBF Volume					
VCU	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
674	0	-	744	940	4,934	5,130
677	0	-	-	684	684	2,864
678	0	-	7,599	11,296	10,029	18,120
679	0	20,785	28,784	49,220	45,817	55,288
680	0	2,964	3,191	1,373	1,472	5,844
681	0	10,281	10,281	10,576	1,254	20,850
682	0	41	4,376	10,653	163	11,500
Total Unit Vol	**0**	**34,074**	**54,975**	**84,742**	**64,353**	**119,596**
Right-of-way Vol*	0	1,376	5,585	2,325	4,192	8,560
Total Volume	**0**	**35,447**	**60,560**	**87,067**	**68,545**	**128,156**

Source: USDA-Forest Service, Ketchikan Area GIS

* Right-of-way volume calculated using average volumes per acre by alternative and adjusting for right-of-way through muskegs and low volume timber stands.

A result of the harvest of timber, as identified in designed harvest units, is the harvest of timber within designated right-of-ways (ROW). ROWs are designed to be the most economical access to the present and future timber resource, in line with protecting and serving other resource needs and meeting Forest Service Standards and Guidelines. Consequently, the volume and type of timber harvested within ROWs is considered incidental to the proposed timber harvest. Table ST-18 displays the estimated volumes of ROW timber proposed for incidental harvest with each alternative. These estimates were

generated electronically, from Timber Type maps, through the Ketchikan Area's Geographic Information System (GIS). Actual area and volume will be established prior to the offering. For more ROW information see the Roads and Facilities section of this chapter.

Cumulative Effects

Cumulative effects result from the incremental effect of an action when added to the past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor, but collectively significant actions taking place over a period of time. This section summarizes the effects of the proposed Chasina harvest upon the environment in combination with the effects of past and proposed future actions.

The earliest commercial timber harvest within the project area was limited to easily accessible coastal shorelines located at various locations in South Arm, Kitkun Bay, and along Clarence Strait. These areas were harvested by dozer and early cable system between the late 1950s and mid-1960s.

The logging of lands conveyed to Alaska Native corporations commenced in the 1980s through present day, with harvest off of Kootznoowoo Native Corporation lands in Dora Bay, East Dolomi, and South Arm.

The suitability analysis performed for this project identified a total of 26,137 acres of suitable forest land, with 1,963 acres previously harvested and available for future harvest.

Table ST-19 displays the acres and percentage of each volume class proposed for harvest, by alternative.

Table ST-19
Distribution Percent and Acres, for Proposed Harvest Units by Volume Class and Alternative

	Vol Class 4		Vol Class 5		Vol Class 6		Vol Class 7		Total*
Alt.	Acres	%	Acres	%	Acres	%	Acres	%	Acres
2	379	33	352	30	342	29	81	7	**1154**
3	583	30	684	36	516	27	117	6	**1900**
4	775	25	1296	46	648	22	214	7	**2883**
5	670	27	892	40	539	23	149	6	**2250**
6	1190	28	1737	42	940	22	323	8	**4190**

SOURCE: USDA-Forest Service, Craig Ranger District Silviculture Report

* Although smaller portions of a harvest unit may be less than Volume Class 4, they are often included for harvest as a result of not being easily delineated for exclusion.

Projected Harvest through completion of the KPC Long-term Contract, 2004

By the year 2004 (when the KPC Long-term Contract expires), up to 31 percent (Alternative 6) of the suitable base is scheduled for harvest. The scheduled acreage, combined with the acreage previously harvested (1,963 acres of second growth), equals approximately 45 percent of the suitable base. Between the end of the long-term contract in 2004, and by the end of the forest rotation in approximately 2054, all suitable volume would be scheduled for harvest to attain the desired future condition. Future timber harvest within the project area could occur as summarized in Table ST-20.

Table ST-20
Cumulative Effects of Timber Entry into Project Area

Alt.	Acres of Proposed Harvest	Percent of Suitable (Direct)	Acres of Potential Harvest 2000-2004	Total Percent Suitable 2004 (Indirect)	Acres of Future Harvest 2004-2054	Percent of Suitable 1955-2054 (Cumul.)	Percent of CFL Harvested 1955-2054
1	0	0	0	0	11,496	100	51
2	1,160	9	3,065	23	10,336	100	51
3	1,900	14	2,325	17	9,596	100	51
4	2,891	21	1,334	10	8,605	100	51
5	2,261	17	1,964	15	9,235	100	51
6	4,225	31	0	0	7,271	100	51

SOURCE: USDA-Forest Service, GIS Data Base

Suitable acreage based on Table ST-15 (11,496) plus 1,963 already harvested.

Falldown

Falldown refers to the difference between planned or scheduled harvest and that which is attained after implementation. Falldown can be categorized in terms of hard falldown and soft falldown (short-term deferral of harvest), and can be further grouped into four types of falldown factors. Most falldown is encountered during field verification of proposed units and roads. Therefore, by conducting field verification prior to sale layout, most falldowns can be determined and accounted for early in the planning process.

Hard Falldown (Suitability Factors)

Hard falldown occurs during harvest unit planning/design, layout, and at the time of harvesting and results in changes to the suitable timber base. Examples of hard falldown include local areas of poor soil stability, rock outcrops, v-notches, noncommercial forest sites, obvious topographic features that preclude logging, and sites that cannot be reforested

in 5 years. Hard falldown also includes lands required for buffers along previously unmapped streams and lands selected by the State or Alaska Native corporations that have been conveyed to their ownership.

Areas that create hard falldown are mapped and entered into the appropriate databases that are used to adjust the suitable acreage for the Forest. These adjustments ultimately affect the Forest database from which the Forest Plan allowable sale quantity (ASQ) is calculated. It should be noted that field verification and office analysis also identify some areas mapped as unsuitable that qualify to be included in the suitable timber base. These areas are mapped and entered back into the database. Recent project experience indicates that the total acres added back to the suitable base tend to be small in proportion to the areas removed.

Soft Falldown (Standards and Guidelines Deferral, Harvest Type, and Economic Factors)

Soft falldown occurs during harvest unit planning/design, layout, and occasionally at the time of harvesting. Areas that create soft falldown are generally short-term deferrals (5-10 years) and typically do not affect the Forest Plan ASQ data base.

Forest-wide standards and guidelines and federal regulations are a primary cause of soft falldown. Examples of soft falldown caused by land use factors include: deferring potential harvest units adjacent to previous harvest areas that have not reached sufficient new tree growth to meet NFMA created opening requirements; deferring potential harvest units in areas/watersheds that have exceeded Forest Plan cumulative effects thresholds; and deferral of potential harvest units to meet TTRA proportional harvest requirements.

Selection of harvest types other than clearcut also leads to soft falldown. Harvest types other than clearcut are sometimes prescribed for protection of natural resources and amenity values. This results in timber volume being retained in the unit for either the short term (e.g., overstory removal with subsequent entries) or the long term (e.g., snag, green tree, or seed tree retention).

Soft falldown due to economic factors occurs when suitable lands are deferred from harvest due to low cost effectiveness. Lands that require many miles of new road construction or expensive yarding systems (i.e., helicopter) are included in this group. These areas remain available for harvest in the future, when economic conditions permit.

Soft falldown could result in lower harvest figures than those shown in previous projects.

Soft falldown occurs in the unit layout process as units are examined more closely through measurements such as profiles. Difficult to reach blind leads will be identified as well as other soft falldown reasons. Broad volume/acre figures from timber-type maps will be refined by cruising standing timber and this will most likely lead to some falldown as will GIS (Geographic Information System) inaccuracies.

In conclusion, planning from general reconnaissance will not result in perfectly accurate volumes/acre because of the difficult topography mapping error and photo interpretation. Only as more time is spent in the field during the layout phase, can greater accuracy be guaranteed.

Interim Changes in Land Use

Emerging land-use issues have the potential to change the future timber supply. This may include deferring potential harvest units (or portions of units) to meet newly defined resource objectives that have not been included in the Forest Plan. An example of this is areas deferred from harvest for protection of karst ecosystems.

Interim changes in land uses have the potential to result in revised land-use allocations under the Forest Plan. Once forest planning adopts revised land uses, the suitable land base, from which the ASQ is calculated, will be adjusted as necessary. These changes in Forest-level planning are not referred to as falldown.

Chasina Project Logging System Transportation Analysis (LSTA)

The original LSTA for the Chasina Project Area identified approximately 13,760 acres of potential units in Management Area K24. From this pool of units the IDT selected 5,410 acres of units that appear to meet current Forest Standards and Guidelines. Additional units were also added from VCUs 674 and 682 for analysis. For a list of units not in the current Chasina unit pool and the reason why not, see Appendix G.

During field reconnaissance, suitable lands were reviewed and more acres were identified as being unsuitable. Four hundred and twenty-two acres, including portions of and total units, were deemed unsuitable because of low volume and incapable of producing industrial wood. Six hundred and six acres were dropped due to irreversible resource damage expected with the logging technology available. Three hundred and fifty-four acres were dropped due to topography limiting its log ability. Two hundred and twenty-two acres of additional TTRA buffers were dropped along with 90 acres of recent state selections.

Acreages

The data base will not show changes in suitable acreage for very small portions of unsuitable land within suitable stands. Only whole stands coded "unsuitable" will be shown as such in the data base.

Estimated Effects on Ketchikan Area Timber Supply

Pursuant to Section 301(e) of the Tongass Timber Reform Act of 1990, the Irland Group was contracted by the Forest Service to prepare an "Assessment of Adequacy of Timber Supply and Analysis of Potential Effects of Eliminating the Long-term Timber Sale Contract Area" (The Irland Group 1991). The Forest Service responded with an "Evaluation of the Irland Group Report" in April 1992 (USDA Forest Service 1992c). Both documents include evaluation of falldown factors. The Irland Group estimated potential falldown at 23 percent of the maximum permitted ASQ; the Forest Service estimate was 31 percent. The Forest Service estimate was further subdivided to identify 21 percent soft falldown and 10 percent hard falldown.

The Irland Group Report, the Forest Service Response to the Irland Report, recent falldown estimates from field verified timber sales, and projections of future falldown and changes in land use are discussed below by falldown category

Hard Falldown - Suitability Factors

Hard falldown due to suitability factors such as very high MMI soils, low site index, and TTRA stream buffers, was estimated at 24 percent of the tentative suitable base, based on recent logging system and transportation plan analysis and layout of units.

Soft Falldown - Standards and Guidelines Deferral

Short-term deferral of harvest to meet Forest-wide standards and guidelines will likely be necessary in the future in areas with high levels of previous harvest. Cumulative watershed, visuals, and TTRA proportional harvest requirements are some of the objectives that can be met through short-term deferrals.

Harvest Type Factors

The use of harvest prescriptions other than clearcut is likely to continue into the future due to concern for amenity values such as visual quality, protection of recreational sites, and wildlife forest structure needs. This will result in falldown from current Forest Plan projections.

The Chasina Project Area will experience a small falldown of reduction in volume over the entire unit pool due to implementing harvest methods other than clearcutting.

Economic Factors

Economic falldown is dependent on changing economic conditions including log prices, cost of accessing harvest units (roads), and efficiency of harvest systems which includes yarding and hauling costs. It varies considerably over the short and long term and its effect on overall timber supply is difficult to quantify accurately. Falldown due to economic factors was estimated by the Forest Service at 21 percent under recent economic conditions (USDA Forest Service 1992c).

For the Chasina Project Area, the risk of falldown due to economic factors could occur in the geographic areas of VCU 677 (Dora Bay) and isolated portions of VCU 680 (northernmost part of the project area) which would require a large amount of road building to access scattered isolated harvest units.

The actual final economic falldown depends on how offering area boundaries are defined. In some cases, economic falldown can be reduced or minimized if lower value areas can be combined with higher value areas.

Ketchikan Area Database Update

In order to more closely estimate potential falldown and change in land use factors, the Ketchikan Area is currently updating several resource databases. Stream databases will be updated to better represent conditions being found during ground verification and project implementation. Additional analysis of slopes, landslides, and V-notches in conjunction with soils will help identify areas that often are inoperable for logging. Logging and transportation analysis for future projects will be performed to quantify how much of the suitable timber base is in the more expensive economic category. The Ketchikan Area update was designed specifically to help address the areas of potential changes in timber supply discussed above and is expected to provide more precision to the quantification of potential falldown and changes in land use. The falldown figures used in the Chasina Project Area are based on ongoing project analysis and are expected to fall within a reasonable range of the Ketchikan Area update results. The Ketchikan Area update information will be used by the Tongass Land Management Planning Team for the TLMP Revision process.

Logging Systems

Yarding is the process of conveying logs from the stump to the landing. This can be done using ground-based equipment, cable logging systems, or helicopters. The method used depends upon many factors including access, topography, slope, and resource protection needs (log suspension requirements).

Ground Based Yarding

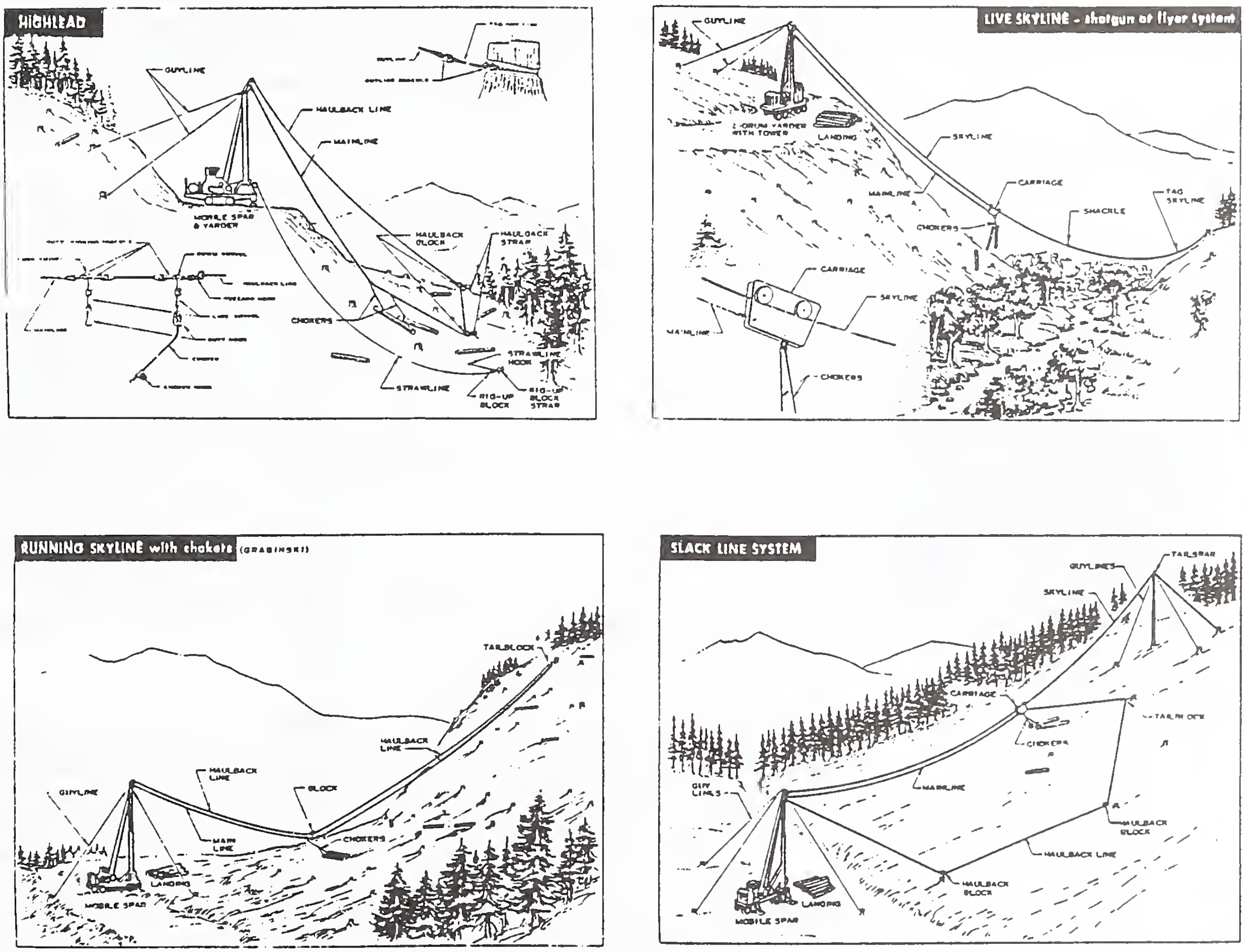
Moist, soft soil conditions in relation with steep slopes found in the project area prove difficult for ground-based equipment operation. Except for a limited amount of shovel logging with track mounted log loaders, there has been little opportunity for this type of equipment. Recently, shovel logging with hydraulic log loaders has added a new dimension to ground based yarding systems. Larger tracks and a lower center of gravity make these machines more stable, lighter, and agile. They also produce a lighter footprint or ground pressure. The objective is to walk a shovel yarder into and through a unit, using the swing boom motion of the loader to swing logs into windrows. This swing procedure is repeated until the logs are moved ultimately to a road or landing. While the project area LSTA process classified units as either cable or helicopter yarded, certain portions of cable units, especially along ROWs, may be suitable for shovel yarding. The decision to actually specify shovel yarding within a given unit is made at the time of unit layout.

Cable Yarding

Cable yarding throughout the Ketchikan Area is comprised of approximately 20 percent slackline yarding, 30 percent running skyline, and 35 percent highlead (Marks 1992). On the project area, running skyline accounts for the majority of the timber harvest methods proposed in each alternative. These yarding systems inherently provide partial suspension or log lift in a majority of uses, but when required, a system capable of providing increased log suspension is identified to meet required management objectives. Figure ST-4 illustrates four systems of cable yarding.

The Forest Service plans and appraises for the most economical yarding system feasible for a particular harvest setting provided it meets management objectives and suspension requirements for the unit. Within the planning process, the running skyline yarding system is used in place of highlead yarding because it is more economical. If at the time of actual unit layout there are no management objectives that require partial suspension (increased log suspension), the highlead yarding system may be utilized.

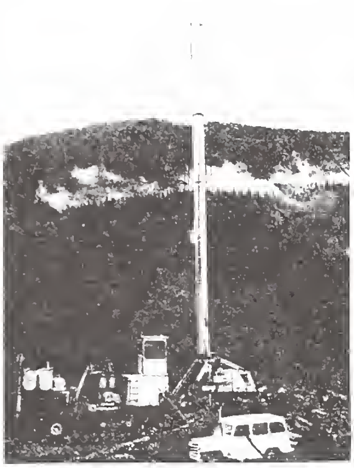
Figure ST-4
Cable Yarding Systems



Highlead Systems

Highlead systems (including Grabinsky or rider block) were previously used more than any other cable system. A two-drum yarder is used. These yarders are typically 90 to 110 foot towers which have telescoping tubes and are tied down with six or eight cables or guywires. One drum holds the mainline which attaches to butt rigging with chokers. The other drum

holds the haulback line which supports the rider or bull block. The haulback also continues on through a block (pulley) and attaches to the other side of the butt rigging. The mainline and haulback control the inhaul and outhaul of the butt rigging. The term highlead refers to the location of the mainline block which is elevated above the ground by the spar. The mainline block (bull or rider block) provides some vertical lift enabling logs to override obstacles, thus minimizing soil disturbance as a "turn" of logs is inhauled to the landing. This system provides minimal partial suspension and is usually designated in areas that have minimal risk of soil disturbance. This system's maximum yarding distance is 1,500 feet uphill, 600 feet downhill. Additional suspension requirements, as well as entry into more difficult terrain requiring longer reaches, favors other systems with expanded capabilities.



Most of the timber in the project area will be removed with cable yarding equipment.

Running Skyline Systems

Running skyline systems require a three-drum "swing" or tower yarder which include a mainline, haulback, and slackpulling lines with hydraulic interlocking capabilities. These yarders are typically shorter (50 to 70 feet) and in the case of a swing yarder, are usually a leaning-lattice type tower that can swing to either side allowing a turn of logs to swing toward a log loader. The interlock system hydraulically ties all three drums together (which rotate at different speeds) to increase overall lifting capability, especially when rigged in a downhill yarding configuration (where braking the haulback line provides the actual log lift or suspension). This system can utilize either a mechanical slack pulling carriage or a mechanical grapple. Both are directly supported by the haulback line. When a grapple is utilized, the slackline and mainline drums control the operation of the grapple which open and close around selected logs which in turn, are yarded to the landing. When a mechanical slack pulling carriage is utilized, the same two drums are used to control the inhaul or outhaul of the skidding line/chokers. While each type of carriage is in common use and provide distinct production advantages, they both provide partial suspension capabilities required to meet most soil management objectives. This system inherently provides increased log lift due to its hydraulic interlocking capabilities. Maximum yarding distance is 1,000 feet uphill, 600 feet downhill.

Live Skyline (Shotgun/Flyer) Systems

Live skyline (shotgun/flyer) systems feature a moving skyline cable which raises and lowers a simple carriage with chokers to a turn of logs. The mainline on a highlead yarder (two drum tower) is used as the skyline and the haulback is used as the mainline, to control carriage inhaul/outhaul. The carriage is gravity outhauled with the mainline controlling both inhaul and outhaul. The term shotgun refers to the high speed that the carriage reaches while outhauling to a turn of logs. The skyline/carriage is then lowered to allow the logs to be choked for inhaul to the landing. This system provides good suspension or log lift to meet partial or some full suspension requirements to meet management objectives. Maximum yarding distance is 1,500 to 2,000 feet uphill.

Slackline Systems

Slackline systems are a configuration of a live skyline systems. A three-drum yarder (tower) includes a skyline, mainline, and a haulback for the inhaul/outhaul of a simple carriage with chokers attached. The main difference is that a haulback line rather than gravity is used to outhaul the carriage. Slackline systems provide excellent lifting capabilities and are employed when management objectives require full or large areas of partial suspension to avoid soil disturbance. Maximum yarding distance is 2,000 to 2,500 feet uphill or 1,000 feet downhill.

Standing Skyline (Long Span) Systems

Standing Skyline (long span) systems are similar to a live skyline system. Long-span skyline is the most common and has two main differences. The first is a non-moving skyline, and the second is the use of a radio controlled carriage. A radio-controlled carriage is used with a two-drum yarder (large towers 90 feet or greater) which employs the use of a skyline and a mainline to support the carriage and to provide inhaul. The radio-controlled carriage has an internal engine which provides the pulling power to skid or inhaul the logs to it. Outhaul of the carriage is by gravity. Skidding line outhaul is controlled by radio; the carriage is stopped and clamped above a turn of logs where the skidding line is dropped to choke the logs. The carriage is then commanded to skid or inhaul the logs up to it where the yarder's mainline inhauls the carriage with the suspended logs to the yarder. This system is used when yarding distances of up to 5,000 feet are required. Shorter span versions of this system include the use of three-drum yarder-controlled carriage or a more simple falling block type carriage which utilizes a two-drum yarder. These include the North Bend (uphill yarding), South Bend (downhill yarding), and the multi-span system (uphill yarding). The multi-span system utilizes intermediate skyline support jacks similar to those found in ski lodge chair lifts. These enable the carriage to carry a load of logs over a topographic break in slope which would otherwise be a blind lead (the skyline bites into the ground). These systems provide excellent lift and log suspension in areas that require full or partial suspension to meet management objectives.

Helicopter Yarding

Helicopter yarding is proposed in all alternatives. Helicopter yarding has been successfully used on all areas of the Tongass National Forest within recent years. On the Ketchikan Administrative Area, Revillagigedo Island, the Painted Peak Timber Sale (4 MMBF), certain portions of the Brown Mountain Timber Sale, and large portions of the North Revilla Project Area were helicopter yarded. With this system, logs are lifted off the ground (fully suspended) and flown to a specially prepared landing. This yarding system causes the least amount of ground disturbance of all the yarding systems, but has the highest yarding cost. The economic feasibility of helicopter yarding is more closely affected by market values than cable yarding. Maximum yarding distance is regulated by economics. Helicopter flight time costs between $2,000 and $5,000 per hour. Maximum flight time between loads or turns of logs is approximately 3 minutes. Factors that affect flight time and economic feasibility include elevational differences between stump and landing, logs/volume per acre, species mix and subsequent value, and payload capabilities of the aircraft.

Helicopter Analysis

A cost comparison analysis for cable versus helicopter yarding was completed on twelve planned units in the South Arm subdivision and eighteen units in the Port Johnson subdivision. The objective was to economically compare cable with road-building costs versus helicopter yarding without road building for the two subdivisions. Both areas are isolated in themselves and have no existing roads.

When lumping all the analyzed units together, the results showed that cable with roads cost the same as helicopter logging without road building. Another comparison was run separating the two subdivisions. In South Arm, comparing all twelve units in cable versus helicopter, cable yarding with roads was 24 percent less than helicopter logging without road

building. In Port Johnson 18 units were analyzed along the isthmus and the peninsula. The assumption was that 18.3 miles of new road construction would be required for log haul to the Lancaster dump versus helicopter logging with no road construction. The result was that helicopter logging was shown to be approximately 24 percent less costly than cable when harvesting the entire unit pool in this area in one entry.

In conclusion, considering the lower cost of cable, road building now in South Arm would leave more options available for harvesting the remaining volume, while keeping salvage opportunities more available. Port Johnson presents a different situation due to its high roading costs, the lack of residual volume outside of the unit pool, and other resource concerns. One entry on the north side and possibly a second helicopter entry on the south side in the future could be justified economically while eliminating adverse effects of roading on wildlife.

Helicopter logging costs may run twice that of cable logging; however, high roading costs can be eliminated. Helicopter logging may be prescribed where road building is economically infeasible or where uneven-aged management (partial cuts or group selections) may be preferred.

Table ST-21
Distribution Percent of Proposed Yarding System by Acres per Alternative

Yarding Type	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Total Unit Pool (Total Operable)
Running Skyline (RS)	28	55	49	60	100	**2,537**
Slackline (SL)	17	55	31	24	100	**363**
Helicopter (HE)*	41	18	N/A	50	100	**907**
Live Skyline (LS)	7	37	55	49	100	**340**
Shovel (SH)	0	100	0	100	100	**17**

SOURCE: USDA-Forest Service, GIS Data Base

* Alternative 2 and 4 helicopter harvest some settings that were designed for cable yarding. Alternative 4 has 1,290 acres of helicopter yarding.

Effects of Proposed Yarding Systems

All yarding is proposed in conformance with national and regional standards and guidelines. Yarding systems were assigned to settings in an interdisciplinary process to minimize any potential or foreseen effects. On-site ground reconnaissance and actual field evaluations during the EIS and layout process will ensure the yarding system assigned will provide the required suspension to meet management objectives as specified by reviewing specialists. For effects analysis see the Soils section of this chapter.

Timber Economics Economic Efficiency Analysis

Current Forest Service Handbook direction (FSH 2409.18; Amdmt. 90-1 and Supp. 6) requires an economic efficiency analysis to compare benefits and costs of a project. Values used in the analysis must reflect middle market timber value estimates that are based on median or middle-level timber market values. In order to account for market fluctuations, weighted average timber values over the past 10 years are used in this analysis.

Forest Service Handbook direction also stipulates that timber harvest projects provide at least 60 percent of normal profit, which must be included when calculating costs. This economic-efficiency analysis is performed by comparing expected gross revenues against estimated costs and arriving at an estimate of net revenues.

Pond log values represent the delivered price of logs at the mill minus the cost to manufacture them into useable products. Pond log values are closely related to volume class data which incorporates log size, grade, and species. On the Ketchikan Administrative Area, the lower volume classes generally have a higher yellowcedar component, which has the highest selling value. On the project area, this results in a disproportionately high Pond log value for the lower volume classes instead of lower, which would reflect the true value of the high elevation (small diameter, low grade) yellowcedar timber.

Stump-to-truck logging costs are subtracted from the pond log values to arrive at a delivered price to the mill. Stump-to-truck logging costs include felling, bucking, yarding, loading, and administrative costs. Logging costs are closely tied to volume per acre (represented by volume class data). Generally, the higher the volume per acre the lower the logging cost. Table ST-22 shows the stump-to-truck logging costs and associated pond values for each volume class.

Table ST-22
Summary of Mid-market Logging Costs and Volume Class Strata

	Volume Class (Dollar Amount per MBF)			
	4	5	6	7
Highlead - Uphill	$224.14	$162.98	$149.44	$131.60
Highlead- Downhill	$225.85	$183.56	$168.20	$147.15
Skyline - Running	$207.26	$158.35	$145.39	$130.32
Skyline - Live	$214.48	$157.69	$145.05	$127.72
Skyline - Standing (long span)	$219.59	$161.42	$148.48	$130.69
Slackline	$242.84	$177.06	$162.78	$143.66
Shovel	$199.83	$145.43	$134.66	$118.47
Helicopter - Water Drop	$343.33	$317.33	$308.97	$298.31
Helicopter - Land Drop	$323.78	$297.78	$289.42	$287.76
Helicopter - Isolated Water	$514.95	$476.00	$463.46	$447.47

SOURCE: USDA-Forest Service

In addition to logging costs, other costs related to truck haul, dump, tow, raft, specified road construction and reconstruction, temporary road construction, LTF construction, camp development, and camp mobilization costs need to be considered when determining the economics of timber sales. For the purposes of this analysis, logging costs plus haul, dump, tow, and raft costs, etc., were all combined into a total transportation cost center. All capital investment costs, such as road, bridge, and LTF construction were combined into a total construction cost center. Table ST-23 summarizes these costs by alternative. Because Alternative 1 does not propose any timber harvest, it is not displayed in the table.

Table ST-23
Summary of Total Transportation and Construction Costs, in Dollars

Alternative	Transportation Costs* ($MM)	Construction Costs* ($MM)	Total Costs* ($MM)	Ave. Cost/MBF
Alternative 2	7.868	2.104	**9.972**	$292.55
Alternative 3	11.159	6.615	**17.774**	$323.00
Alternative 4	21.451	3.495	**24.946**	$294.15
Alternative 5	13.980	5.735	**19.715**	$306.17
Alternative 6	27.339	10.866	**38.205**	$319.18

SOURCE: USDA-Forest Service

* rounded to the nearest thousand

- Costs per MBF are lowest for Alternatives 2 and 4.

- Total costs per MBF were highest for Alternative 3 ($323.00/MBF), since that alternative would need substantial amounts of road to reach smaller and more isolated units, also resulting in the highest construction costs per MBF (see Table ST-23).

- Transportation and construction costs per MBF are lowest for Alternative 2 ($292.55) because less road construction would be required and fewer units will be helicopter yarded. The logging costs of successive entries can be expected to increase, due to the projected increase in the proportion of isolated volume within the project area.

- The high costs associated with Alternative 6 reflect the higher costs of having to access more marginal timber. This essentially depicts the higher costs that may be associated with any future entry where timber is harvested in areas increasingly more difficult to road. A future entry, without the volumes of Alternative 2 to carry it, could have a net value lower than this entries Alternative 2.

- Alternatives 2, 3, 4, 5, and 6 include helicopter logging, which is a more expensive yarding system than cable logging. Helicopter costs were derived by using average cost/MBF from the Polk Inlet Project Area offers. These costs were adjusted based on unit location (elevation) and flight distance the logs had to be flown to the nearest landing. These costs were further adjusted for the appropriate mid-market base period by volume class.

Estimated net timber value (stumpage) is arrived at by subtracting all associated costs from the pond value for all proposed harvest units in each action alternative. Consequently, individual units which may be uneconomical to harvest by themselves are offset by

combining them with other units which are more economical to harvest. This results in less productive land or land where the timber is highly defective being made more economically viable for timber harvest. These lands are then brought under management, thereby increasing future timber yields and postponing entry into more environmentally sensitive areas.

These projected construction costs, transportation costs, and pond log values are estimates, not actual costs, which form a constant by which all alternatives may be compared. Before the timber is sold, the volume within the units and ROWs will be cruised and appraised to determine the actual volume and value of the timber. Because all action alternatives are measured against the same yardstick of estimated costs, it is appropriate to rank the alternatives in order by net value. Table ST-24 shows the estimated value and ranking of each alternative based upon the net value. Net values are shown rounded since the figures are based on estimates. Because Alternative 1 has no timber harvest costs or values, it is not listed.

Table ST-24
Summary of Harvest Unit Estimated Stumpage Values by Alternative, per MBF (based on Mid-market Analysis)

Alt.	Estimated Total Volume (MBF)	Total Pond Value*	Total Trans. Costs** ($Millions)	Total Const. Costs*** ($Millions)	Estimated Net Value @ Mid-market	Estimated Net Value @ Current-market	Rank Order
Alt. 2	34,086	$332.22	$7.868	$2.104	-$23.45	+$154.31	1st
Alt. 3	55,028	$332.22	$11.159	$6.615	-$53.90	+$123.86	5th
Alt. 4	84,806	$332.22	$21.451	$3.495	-$25.05	+$152.34	2nd
Alt. 5	64,393	$332.22	$13.980	$5.735	-$37.08	+$140.68	3rd
Alt. 6	119,698	$332.22	$27.339	$10.866	-$50.08	+$127.68	4th

SOURCE: USDA-Forest Service

* Values are meant for comparative purposes only.
** Transportation costs include all costs not associated with capital investments or costs normally connected to road construction, such as: fall, buck, yard sort, load, haul, dump, raft, and tow.
*** Construction costs include costs associated with LTF development, road construction and reconstruction, such as: pit development, clearing, grubbing, embankment, haul, excavation, and related material, such as bulkheads, bridges, and culverts.

Based on this analysis, not all mid-market values for each alternative show a positive net stumpage. However, costs for temporary road construction and specified road reconstruction may fluctuate when updated for the offering appraisal. Changes in logging costs and selling values can also have an undetermined effect on overall stumpage values; however, these changed values will not alter the order without modifying the alternative. Alternative 2 shows the highest relative net stumpage (-$23.45/MBF), while Alternative 3 shows the

lowest (-$53.90/MBF). Further analysis for current-market values indicate a positive return for all alternatives (See Table ST-24). However, fluctuations in pond log values or logging/road construction costs may cause net values to change. Alternative 2 has the least threshold before becoming a negative net value. At current rates, with predicted higher pond values, all alternatives will be expected to have a net value which exceeds preparation and administration costs to the Forest Service.

Socio-Economic Environment

Key Terms

Cant — a log partly or wholly cut and destined for further processing.
Direct Effects for Employment and Income — those effects that impact sectors either exporting goods and services from the primary zone of influence or selling those products to final consumers within the zone. An example of direct employment would be people working in a sawmill.
Extended Primary Region of Influence (ROI) — the area that would sustain the largest indirect economic impact from socioeconomic changes in the Primary ROI.
Indirect Effects for Employment and Income — those effects that are linked to the direct effects by providing goods and services to the directly affected sectors. An example of indirect employment would be people who work in a generating plant that sells electricity to a sawmill.
Induced Effects for Employment and Income — the effects that are linked through the direct and indirect effects income that consumers spend within the area. An example of induced employment would be grocery store employees who sell products to the people working in a sawmill or generating plant.
Mid-market — an economic estimate of timber value at a point in time when half of the timber was harvested at a higher value and half was harvested at a lower value.
Present Net Value — the difference between benefits and costs associated with the alternatives.
Primary ROI — the area whose population would sustain the largest socioeconomic impact resulting from the implementation of any of the proposed timber harvest alternatives in the Chasina Project Area.
Public Net Benefits — a measurement of economic efficiency. PNB are the sum of present net value and non-priced commodities (such as scenic quality and community stability).
Secondary ROI — includes the entire State of Alaska, other Pacific Northwest states, and countries having direct trade with the Primary and Extended Primary ROIs.

Affected Environment

Introduction

Nearly 80 percent of Southeast Alaska is located within the Tongass National Forest, an area larger than the State of West Virginia. This area stretches roughly 500 miles from Ketchikan in the southeast to Yakutat in the northwest, and is mainly unpopulated wild country. Approximately 73,000 people live in 32 towns, communities, and villages located in or very near the boundaries of the Tongass, which is the largest forest in the National Forest System.

The economies of most communities in Southeast Alaska depend almost exclusively on the Tongass National Forest to provide natural resources for uses such as fishing, tourism, recreation, timber harvesting, mining, and subsistence uses. There is very little private land to provide these resources. Consequently, maintaining the abundant natural resources found on the Tongass is a major concern of those who make their living here.

In addition to economic activity, the quality of life is greatly enhanced by the physical environment associated with the Tongass. Southeast Alaska is regarded as a wild and magnificent place, a vast expanse of seemingly limitless scenery and vast natural resources. Many Southeast Alaskans want to preserve their local environment while maintaining their economic livelihood. With a limited resource base, resolution of this conflict is becoming increasingly difficult.

Southeast Alaska Regional Economy

The output of the Alaskan economy is dominated by the export of fishery and forestry products, the sale of North Slope oil, and the accommodation of out-of-state tourists. Because it is largely an export-oriented economy, it is heavily dependent on global macroeconomic conditions, particularly those besetting Japan and the other Pacific Rim countries.

The public sector has a significant presence in the region. State and local government employment is heavily influenced by the level of oil royalties returned to the State from Federal leases of off-shore tracts. Based on 1986 figures, Alaska's trade was led by fishery products (38.4 percent), oil and gas (22.6 percent), and wood products (9.9 percent). Historically, the rise in world oil prices from 1978 to 1982 resulted in a high growth of Alaska's economic output. This growth was faster than the United States as a whole during the same period. In 1983, the sharp rise in the value of the dollar began cutting deeply into the competitiveness of Alaskan exports. By 1985, the precipitous fall in the price of crude oil and the rise in the value of the dollar decimated Alaskan exports, and the Gross State Product contracted was substantially reduced (Forest Service 1990b).

The sensitivity of the Alaskan economy to foreign markets is reaffirmed through the observed congruence between the quantity of Alaskan exports of forest products and the economic indicators of the Janapese economy. Japan is the principal destination for Alaska's exports of forest products. As such, Alaskan exports of timber and wood products are highly dependent on wood product demand within the Japanese economy as well as the relative strength of the yen with respect to the dollar.

The dependence of the region's economy on foreign demand is widely understood in the local communities. This economic vulnerability heightens the desire to both broaden the base of economic activity and stabilize the existing job market through establishing continuity in resource supply. Although employment fluctuations over the business cycle are unavoidable, economic diversification reduces fluctuations driven by outside forces that are largely beyond direct fiscal and monetary influence of local and national policy makers.

Region of Influence (ROI)

The Primary ROI is the area whose population would sustain the largest socioeconomic impact resulting from the implementation of any of the proposed timber harvest alternatives in the Chasina Project Area. For purposes of this analysis and based on regional expenditure, consumption, and residential characteristics, Prince of Wales Island has been designated as the Primary ROI. The major economic resources of the Primary ROI include recreation, fish, wildlife, and timber. Each resource is used, processed, or consumed by overlapping segments of the population located in varying proximity to the project area.

Within the Primary ROI, the four most populated communities are the cities of Craig, Hydaburg, Klawock, and Thorne Bay. These four communities have a combined total population of approximately 3,750 (U.S. Department of Labor 1995). Because of their

proximity to the project area, the demographic and socioeconomic characteristics of the towns of Coffman Cove, Kassan, Metlakatla, and Hollis will also be discussed.

The Extended Primary ROI is the area that would sustain the largest indirect economic impact from socioeconomic changes in the Primary ROI. Based on regional consumption and employment patterns, it was determined that the Ketchikan Gateway Borough, primarily the City of Ketchikan which is the largest regional distribution center of consumer goods and services in proximity to the Primary ROI, would sustain the largest concentrated indirect economic impact resulting from implementation of any of the proposed timber harvest alternatives.

The Secondary ROI includes the entire state of Alaska, other Pacific Northwest states, and countries having direct trade with the Primary and Extended Primary ROIs. Because any economic impacts on the Secondary ROI, caused by implementation of any of the timber harvesting alternatives in the Chasina Project Area, are expected to be negligible, its further discussion is considered moot.

Demographic and Income Characteristics

State of Alaska

Between 1960 and 1990, the population of the State of Alaska grew from 230,400 to 550,000, an increase of nearly 139 percent. By and large, population growth has been relatively consistent throughout the 30-year period. According to 1990 Census data, population growth in the State of Alaska seems to have slowed down. Two of the primary factors in the slowdown appear to be the crude oil glut of the late 1980s, which resulted in production stabilization, as well as a reduced demand for Alaska timber. In both cases, demand for labor was not as high as initially projected, producing a lower than projected population influx.

Proportionately, the State of Alaska has a higher percentage of its population living below the poverty line than the rest of the nation. The national average is approximately 12.4 percent, while the State of Alaska's is 14.4 percent. The national population classified as living in poverty has a larger average proportion of singles and single-parent households than the State of Alaska. The demographic makeup of those classified as living beneath the poverty line in the State of Alaska includes a greater proportion of two-parent households.

The reason for the proportionally higher ratio of entire families living beneath the poverty line may partly be attributable to the heavy reliance on subsistence by many of Alaska's residents, particularly those of Southeast Alaska. Reliance on subsistence fishing and hunting results in the accumulation of goods without the transfer of money. This, in turn, makes any accounting of such activity difficult and highly inaccurate. The social and economic system established among many who rely on subsistence includes unofficial parallel market driven by a "complementary" barter system. In other words, a hunter will give his neighbor part of the game he caught as a gift. His neighbor the fisherman will return the favor sometime in the future with the delivery of some catch. The current measure of accounting used in establishing social and demographic statistics makes it difficult to accurately account for such transactions, and therefore, does not give a complete picture of the welfare of many of the residents of the state, particularly those of Southeast Alaska.

Southeast Alaska—Tongass National Forest

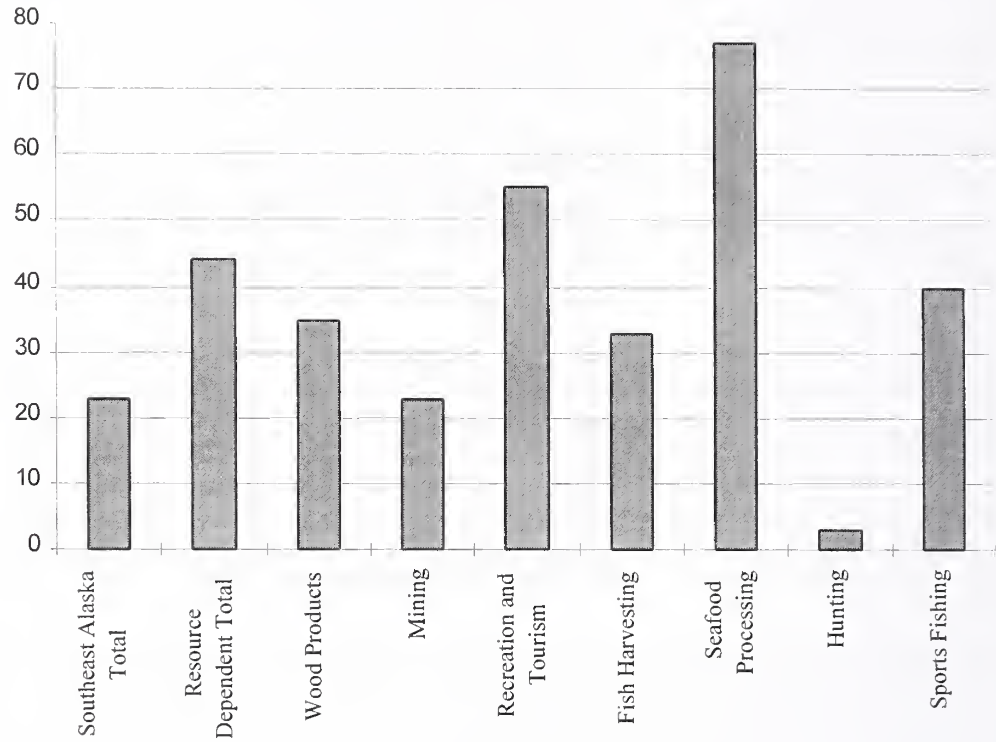
The majority of communities in Southeast Alaska are small, isolated from each other, and accessed only by air or water. Only four communities in the region are accessible by land:

Skagway, Haines, and Klukwan in the north, and Hyder in the south. Juneau, Alaska's capital with a population of nearly 24,000, is the largest community in Southeast Alaska. It is the only community with a population exceeding 20,000 and represents 40 percent of the region's total population. The mid-sized communities in Southeast Alaska are Sitka and Ketchikan, with approximately 8,200 and 15,080 residents, respectively. The combined population of Juneau, Sitka, and Ketchikan comprise approximately 70 percent of the total population of Southeast Alaska (U.S. Department of Commerce, Bureau of the Census 1991).

Southeast Alaska communities exhibit varying degrees of economic development and diversity; while fishing, timber, tourism, mining, and government are the major economic sectors, the importance of these activities is characterized by considerable local variability.

Some communities have little or no local economy in the conventional sense, and rely heavily on local fish and game resources. In some cases, sources outside the community play a major role in supplying goods and services that cannot be obtained from local subsistence. Some community-use activities depend upon a single economic activity that supports a viable local economy while others have a full range of economic variability. Although Southeast Alaska's relative economic condition is good, income and poverty levels throughout its communities vary. The larger communities of Ketchikan, Juneau, Wrangell, Petersburg, and Sitka have income levels well above the national average, with a smaller percentage of the people living below poverty levels. In many of the smaller communities, where reliance on subsistence is more pervasive, the relative proportion of individuals and families living beneath the poverty level tends to be higher. However, as previously shown, the latter is a somewhat deceiving assertion because many people in these communities rely at least somewhat on hunting, fishing, gathering, and other forms of subsistence for their livelihood. This results in a reduced volume of actual financial transactions.

Figure SE-1
1994 Nonresident Share of Direct Employment, Southeast Alaska Total and Resource Dependent Industries



Source: Alaska Department of Labor and others.

Note: All employment figures are standardized to average annual employment.

Two other characteristics of employment are of specific relevance to Southeast Alaska. These are the nonresident share and the seasonal variation in industry employment, and they are highly correlated. Nonresident shares for Southeast Alaska total employment and direct employment in the resource dependent industries are shown in Figure SE-1. At 44 percent, the share of nonresidents in the resource sector is approximately twice that for all industries within the region. This is mostly the result of the high proportion of nonresidents working in the seafood processing and recreation and tourism sectors. It must be noted, however, that just because an employee is a nonresident, this does not mean that the job is somehow less valuable. Nonresident shares merely help to indicate how much of the benefits generated by

an industry stay in the region. The seasonality of employment is another factor for Southeast Alaska, where the difference between peak levels of employment in the summer and lows in the winter are quite pronounced.

Southeast Alaska Social Environment

Because of the overall commonality in the social and economic character of towns involved in similar economic activities in the region, a discussion of the social environment will focus on regional characteristics.

Lifestyles

Lifestyles and the economic pursuits of residents of Southeast Alaska are varied. Many live in Southeast Alaska because of the opportunity to participate in resource-extraction occupations, primarily timber harvesting and commercial fishing. Some desire the lifestyles afforded by remote, uncrowded living situations, while others prefer the region because of the hunting and fishing opportunities.

Community Stability

Community stability is a very important consideration in planning any resource management activity in a National Forest, but it is also an evasive element to accurately describe. While income levels, employment rates, regional economic output, and so forth are useful indicators of socioeconomic trends, they do not portray the total picture, particularly the quality of life aspects.

The balance of a variety of natural human-related resource activities is important to communities in Southeast Alaska. Management of the Tongass National Forest has direct and indirect impacts throughout the region on the level of regional economic activity as well as the quality of life. Many of the residents of the communities in Southeast Alaska derive their livelihood directly and indirectly from the forest. These residents are also affected by changes in environmental quality, and benefit from the availability of free and abundant resources and products from the forest. The preservation of adequate available levels of firewood, wildlife, and fish are significant to the sustenance and growth of the local economics, as well as the quality of life of the area's residents. In light of their potential impact on community stability, forest management activities are of great public interest.

Community Profile (Primary ROI)

Because of the number and variety of small communities within the Primary ROI, the four most populated towns—Craig, Hydaburg, Klawock, and Thorne Bay—have been selected for close review and subsequent impact analysis. These four towns differ in their population and economic profiles. Therefore, the level and significance of any economic impacts which they may sustain will differ. Understanding some of their basic differences allows for a more poignant and specific impact analysis. The examination of each of the following communities, coupled with the socioeconomic impact analysis, is designed to allow the reader a method by which to infer the level and significance of potential economic impacts on similar but smaller communities within the Primary ROI. Due to their proximity to the project area, the demographic and socioeconomic characteristics of the towns of Coffman Cove, Kasaan, Metlakatla, and Hollis will also be discussed. Demographic and communal characteristics of Prince of Wales Island and the individual towns are discussed below.

Prince of Wales Island

Located about 45 miles west of Ketchikan, with an approximate population of 5,154 (Boucher and Tromble 1996), Prince of Wales is the third largest island in the United States. The four major communities on the island are Craig, Klawock, Thorne Bay, and Hydaburg. The island has been the site of several lumber mills and mining camps since the 1800s. However, it was the salmon harvest that led to its permanent settlement. Klawock was the site of one of Alaska's first canneries, built in 1878. In the following years, 25 canneries were built on the island to process salmon, but none are in operation in recent years. Today, logging is prevalent on the island. Most of the island is National Forest System land, although there are several Native corporations which own and manage land, as well as private land holdings. In addition to timber harvesting and commercial and subsistence hunting and fishing, Prince of Wales Island offers opportunities and facilities to attract tourists.

Craig

The community of Craig is located on the west side of Prince of Wales Island. The town can be accessed directly from outside the island through its boat harbor and seaplane float, or via ferry service on the east side of the island. Craig was once a temporary fishing camp for the Tlingit and Haida people, natives of the region. In 1907, with the help of local Haidas, Craig Millar established a saltery on Fish Egg Island. Between 1908 and 1911, a permanent saltery, cold storage facility, and about two dozen houses were built at the town's present location and the settlement was named for its founder. The town was incorporated in 1922 and continued to grow throughout the 1930s. Although the salmon industry has both prospered and floundered over the years, fishing still accounts for about half of the employment in Craig today. In recent years, increased timber harvesting on the island has contributed jobs in logging and timber processing.

As the most populated town in the Prince of Wales Island Outer Ketchikan Census Area, Craig serves as the primary retail trade center on the island. With an estimated 1,946 residents, Craig is home to approximately 38 percent of the island's population (Table SE-1). Overall, the demographic distribution of the town's population is similar to that of the state. However, the town's remote nature is such that its population base is younger and appears to be more transient than the state overall. Craig's economic welfare appears to be primarily dependent on the stability of direct employment, income, and subsistence afforded to its local population from timber harvesting, fishing, and hunting. To a lesser extent, Craig's economy depends on the welfare of residents of surrounding towns who comprise a significant portion of the customer base for Craig's merchants.

City of Thorne Bay

The City of Thorne Bay began as a logging camp in 1962 and was incorporated in 1982, making it one of Alaska's newest cities. Currently, employment in the town largely depends on logging, with the municipal government and a few local trades and services providing some additional jobs. Although tourism is not a mainstay of the town's economy, Thorne Bay does offer recreation opportunities as well as accommodations for its few tourists.

Because of its heavy direct economic dependence on logging and timber production, the town's population differs in its demographic makeup from Craig and most other regional towns whose economies, although dependent on timber harvesting, are more diverse. KPC has a log sorting operation at Thorne Bay; logs from the project area would provide employment to Thorne Bay residents. The City of Thorne Bay's population was last reported as 650.

A detailed breakdown of some demographic and housing characteristics of the City of Thorne Bay is presented in Table SE-1.

Table SE-1
Selected 1995 Population and Housing Data

	Alaska	Craig	City of Thorne Bay	Hydaburg	Klawock	Kasaan	Hollis CDP	City of Coffman Cove	Ketchikan
Total Population	550,043	1,946	650	406	759	41	106	254	8,263
Male (%)	52.7	53.1	53.8	57.0	54.9	48.2	55.0	64.0	51.8
Female (%)	47.3	46.9	46.2	43.0	45.1	51.8	45.0	36.0	48.2
Median Age	29.4	28.5	31.4	28.3	29.5	31.3	36.7	34.5	31.7
Percent of Total Population Under 18	31.3	34.1	34.4	35.4	32.0	33.3	29.7	25.8	27.5
Race and Hispanic Origin (%)									
White	75.5	76.1	97.2	10.4	44.9	46.3	95.5	92.5	78.3
Black	4.1	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0
Alaska Native	15.6	22.9	1.2	89.1	54.3	53.7	2.7	7.0	15.7
Hispanic	3.2	2.4	2.3	0.5	1.7	1.9	0.9	1.1	2.5
Median Housing Price	$94,400	$94,400	$56,700	$60,000	$75,900	$55,000	$50,000	$26,300	$105,200
Median Rent Occupancy and Tenure	$503	$533	$398	$231	$414	$338	$275	$271	$530
Owner Occupied (%)	56.1	63.1	53.1	61.0	55.2	63.2	81.4	49.3	46.3
Renter Occupied (%)	43.9	36.9	46.9	39.0	44.8	36.8	18.6	50.7	53.7
Seasonal or Occasional Use (%)	7.3	3.6	3.0	1.5	0.7	3.3	36.6	1.2	0.8
Mobile Houses, Trailers, Other (%)	10.6	58.1	10.6	11.1	45.9	20.0	11.3	81.5	7.1

SOURCE: Polk Inlet EIS, with 1995 population updates from Alaska Department of Labor, Research and Analysis Section 1996.

Hydaburg

The town of Hydaburg was founded in 1911 from a combination of the populations of three Haida villages. Of its total population of 406 (Alaska Department of Labor 1996), nearly 90 percent are classified as Alaskan Natives. The town's residents are largely involved in commercial fishing, although there are some jobs in construction and the timber industry. Subsistence is also prevalent among many of the town's residents. While housing prices in Hydaburg are comparable with those of the City of Thorne Bay (approximately 10 percent higher on average), unlike Thorne Bay, its residents are generally not transient. This is reflected by the nearly 75 percent of 1-unit detached housing units comprising the housing market. A detailed breakdown of some demographic and housing characteristics of Hydaburg is presented in Table SE-1.

Klawock

Klawock is located on the west side of Prince of Wales Island just north of Craig. Tlingit Natives have lived in the same area, near the Klawock River, for at least 600 years. Present-day growth and development of Klawock began with commercial fisheries and with the first salmon saltery in Southeast Alaska. Two additional canneries were built in 1920 and 1924, along with an associated sawmill. In 1971, a major sawmill was constructed that operated intermittently. With harvest of Native corporation lands in the vicinity of Klawock, the ANCSA village corporation of Klawock-Heenya constructed docking and log transfer facilities near the city. Klawock is now the center of the Tlingit population on west Prince of Wales Island (TLMP Draft Revision). Over the years, the population of Klawock, like other Southeast communities, grew and then declined with the salmon harvest. The local economy is still dependent on fishing and cannery operations, along with timber cutting and sawmilling. Of its 59 residents, approximately 55 percent are Alaskan Natives. A detailed breakdown of some demographic and housing characteristics of Klawock is presented in Table SE-1.

Kasaan

The city of Kasaan is a small Haida village at the head of Kasaan Bay. It is one of a few scattered villages on the island not connected by road; but construction of a tie road to Thorne Bay is underway. Its population of 41 (Alaska Department of Labor 1996) is almost evenly divided between Alaskan Natives and whites. The town's residents lead a predominantly subsistence lifestyle. The Tongass Resource Use Cooperative Survey (TRUCS) (Kruse and Frazier 1988) lists the following economic sectors for Kasaan: fisheries, educational services, and local government. The average annual per capita income in 1990 was the third lowest in the project area and less than the State and Southeast Alaska averages (Kruse and Muth 1990). A detailed breakdown of some demographic and housing characteristics of the city of Kasaan is presented in Table SE-1.

Hollis

Hollis was a mining town with a population of 1,000 from about 1900 to 1915. In the 1950s, Hollis became the site of a Ketchikan Pulp Company logging camp, and served as the base for timber operations on Prince of Wales Island until 1962, when the camp was moved to Thorne Bay. Recent State land sales have spurred the growth of a small community of approximately 100 people. A detailed breakdown of some demographic and housing characteristics of Hollis is presented in Table SE-1.

City of Coffman Cove
Coffman Cove is a small logging community with a total population of 254 (Alaska Department of Labor 1996). It is one of the largest independent logging camps in Southeast Alaska.

The seasonal nature of the local economy of this town makes most of its residents transient by nature. This assertion is affirmed by examination of the town's housing market. As indicated in Table SE-1, over 80 percent of housing units in Coffman Cove are categorized as mobile home or trailer indicating a higher than average mobility by a majority of the town's residents. A detailed breakdown of some demographic and housing characteristics of Coffman Cove is presented in Table SE-1.

Metlakatla
Metlakatla is located on Annette Island in southern Southeast Alaska, 15 miles south of Ketchikan. Its population of 1,600 includes 84 percent Alaska Native (Alaska Department of Community and Regional Affairs (ADCRA) 1995).

Although Metlakatla is believed to have been occupied at one time by Tlingit Indians, it was settled in 1887 by Church of England minister William Duncan and about 830 Tsimshian followers from northern British Columbia. In 1891, an Act of Congress declared Annette Island an Indian Reservation (the Annette Island Reserve), the only one in Alaska.

Metlakatla is a traditional Tsimshian community with an active economy and subsistence lifestyle. The community was not part of ANCSA, rather, the 86,000 island reservation and surrounding 3,000 feet of coastal waters are not subject to State jurisdiction. It regulates commercial fishing in these waters, and operates its own tribal court system (ADCRA 1994).

The community of Metlakatla has prospered in part due to its successful involvement in commercial fishing and lumber industries. Metlakatla's economy is structured around fishing and wood products industries, and because it is an Indian Reservation, there can be no local tax base (ADCRA 1994). The first developments included a community retail outlet, sawmill, and salmon cannery. KPC owns the primary sawmill in Metlakatla. Subsequent developments included continuous upgrading of the cannery, fish traps, fishing fleet, sawmill, hydroelectric and diesel generation plants, and constructing a cold storage operation. In 1977, the Tamgass Creek Hatchery opened. The community-owed and operated salmon cannery, including an egg house, is the center of activity from mid-June through November each year. The Annette Island Packing Company contracted with a Japanese firm to sell salmon eggs and herring roe to Japan (ADF&G 1994).

Timber and fishing are key economic sectors, however the largest employer is the Metlakatla Indian Community. Its 1989 median household income was $37,143 (ADCRA 1995). Unemployment in this census area is 12.5 percent, compared to 8.2 percent in all of Southeast (Alaska Economic Trends 4:1995).

Summary
As indicated in Table SE-1, there appears to be a consistent trend in the transient nature of the population and its ethnic makeup. This is substantiated by an examination of the housing

markets of the four largest communities on the island. The seasonal nature of employment in Southeast Alaska requires a flexible work force. This work force utilizes temporary housing during the primary operating period.

Extended Primary ROI

Ketchikan

Ketchikan is located on Revillagigedo Island. The Ketchikan vicinity includes Saxman, Mountain Point, Clover Pass, Ward Cove, and Herring Cove which are located on the Ketchikan road system and Pennock Island. The Ketchikan area was a summer fishing camp for the Tlingit Indians. Development began with a saltery at the mouth of Ketchikan Creek. Ketchikan was a boom town in the late 1800s. Since the early 1900s, timber products have been an important economic influence. A world-scale pulp mill was built in Ward Cove in 1954. Due to its location as a transportation center, fishing center, and focus for the subregion's timber industry, Ketchikan grew rapidly in the 1950s. Recently, government, tourism, and services have grown in economic importance. Mining could become important with the pending development of the Quartz Hill mine.

Ketchikan is the fourth largest and the most visited city in the entire State of Alaska. Cruise line traffic alone is estimated to contribute almost $12 million annually into the local economy (Alaska Department of Labor 1992). Along with tourism, Ketchikan's economy is largely dependent on timber and fishing. Therefore, economic welfare is dependent to a large extent on the state of the economy of the lower 48 states and that of Japan.

Ketchikan's labor force parallels the seasonal fluctuations of the local economy and its industries. Unemployment rates peak in the winter and fall, and is lowest in the summer as wood products, fishing, and tourism reach maximum output and labor demand. Poor weather limits access for industrial operations during the winter months. The seasonal nature of employment moderates in the potential increase in unemployment during the mid-winter months of December through March. When a downturn in the local economy creates excess labor, many people leave the area migrating to areas with favorable job opportunities.

Overall, Ketchikan's demographic makeup is similar to that of the State of Alaska. Ketchikan's larger economy and housing markets have resulted in a higher proportion of renter-occupied housing units than that of the State. The transient nature of some of Ketchikan's labor force does, however, support the previous assertion which claimed a positive correlation between the degree of transience in the labor force and the size of its white community.

Table SE-2 displays the level of employee compensation, total income, and jobs derived from the major industry groups in the extended primary region of influence.

Table SE-2
Ketchikan Gateway Borough Employment and Wages by Industry for 1994

Industry	Yearly Earnings (MM$)	Annual Employee Income (M$)	Number of Jobs
Agriculture, Forestry, & Fishing*	3.8	47.2	81
Construction	17.7	48.0	370
Manufacturing**	53.5	35.2	1,522
Transport, Comm. & Utilities	24.8	33.0	753
Wholesale & Retail Trade	32.0	20.6	1,554
Finance, Insurance & Real Estate	7.3	25.1	291
Services	30.1	22.6	1,333
Government	69.3	38.3	1,811
Total	**$238.5**	**$270**	**7,733**

SOURCE: Alaska Department of Labor, Research and Analysis

* Does not include independent fishermen.
** Includes logging, sawmills, and pulp mills.

Economic Use of the Forest

The proposed actions in the Chasina Project Area may affect the economic use of the forest by three major industries: timber, commercial fishing, and recreation including tourism. Table SE-3 displays 1990 employment information for these three major industries. For each industry, direct, indirect, and total employment is listed. In addition, for each industry, the percent of the total Southeast Alaska employment is shown.

Table SE-3
Employment and Earnings, Resource Dependent Industries and Southeast Alaska Total

	Individuals Employed (Average Annual Jobs)				Employee Earnings			
Industry	1994 Direct Employment	Change 1980-94	% of SE AK Total	1994 Total Employ-ment	1994 Direct Earnings (MM$)	% of SE AK Total	1994 Average Annual Earnings	1994 Total Earnings (MM$)
Wood Products	2,204	16%	6	3,439	96	9	43,453	129
Mining	163	-21%	0	284	10	0	59,481	17
Recreation and Tourism	2,771	100%	7	3,664	86	8	30,996	114
Salmon Harvesting	1,899	-0%	5	2,697	41	4	21,425	58
Seafood Processing	1,646	16%	4	3,160	42	4	25,437	80
Resource Dependent Total	**8,683**	**27%**	**23**	--	**274**	**24**	**31,546**	--
Southeast Alaska Total	**37,107**	**21%**	**100**	**37,107**	**1,119**	**100**	**30,158**	**1,119**

SOURCE : TLMP RSDEIS 1996a

Note: Recreation and tourism employment and income estimated from 1990 levels (derived from regional input/output model) using recreational use on the Tongass as an index. Total resource dependent employment and income is omitted because of inability to sum resident and non resident measures.

As Shown in Table SE-3, salmon fishing, when combined with seafood processing, provides the most direct and total employment, followed by recreation and tourism and then by timber. Direct employment in the three industries results in a labor force that exceeds 8,600 and is more than 23 percent of the regional employment.

The wood products industry had the greatest total earning ($129 million) mostly due to the fact that they are better paying jobs. Each of these industries interacts with other sectors of the economy. Therefore, implementation of a policy that affects one or more of these industries would affect other sectors of the economy. Additionally, each of the three industries includes a number of subcomponents. The timber industry directly affects several economic sectors including heavy construction, lumber and paper products, and water transportation. The commercial fishing industry includes the harvesting, processing, manufacturing, support, and transportation of fish or related products. The recreation and tourism industry directly affects several economic sectors including the retail trade, service, and transportation sectors. The industry includes guides and outfitters, tours and transportation services, and sport hunting and fishing support services.

Timber Industry

Industry's History and Overview

Before 1950, the timber industry was a small portion of Southeast Alaska's economy. Numerous sawmills were located at such places as Juneau, Petersburg, Wrangell, and Ketchikan. A plywood mill operated at Juneau and a pulp mill at Port Snettisham (south of Juneau). Since 1950, the timber industry has become a major economic and social factor in Southeast Alaska.

Today, the forest products industry in Southeast Alaska processes a wide spectrum of spruce and hemlock logs into cants and finished lumber products. The wood waste produced in sawmills is used for energy, slabs, edgings, and pulp fiber. In addition, a new market in Asia has developed for logs from lands conveyed to Alaska Native corporations through the Alaska Native Claims Settlement Act (ANCSA) (Public Law 92-203). The historic timber industry employment in Southeast Alaska has varied from a low in 1985 of about 2,000 to a high in 1990 of about 3,500 (TLMP RSDEIS 1996a).

Under the terms of the ANCSA, 13 Native corporations in Southeast Alaska were entitled to select 540,000 acres of land out of the Tongass National Forest. Approximately 95 percent of these lands have been conveyed. More than 3 billion board feet have been harvested from these lands and exported as unprocessed logs. It is estimated that between 1984 and 1989, the harvest on Native corporation lands increased almost 300 percent. Unprocessed log exports have displaced cants in the export markets. The export market for round logs has increased because of limited log availability from the Pacific Northwest.

Up until 1994, the Alaska Pulp Corporation (APC) in Sitka and the Ketchikan Pulp Company (KPC) in Ketchikan made up Southeast Alaska's pulp industry. In April of 1994, APC discontinued operations and consequently its long-term sale contract with the Forest Service was canceled. The Ketchikan Pulp Company produces a special alpha-grade dissolving pulp for both domestic and export markets. Of the timber harvested from Southeast Alaska, 50 percent (primarily western hemlock) is used for pulp. Sources of pulpwood are the Tongass National Forest, Native corporations, and the State of Alaska. Depending on market conditions, the pulp mills have imported logs from British Columbia.

Timber Supply and Markets

In Southeast Alaska, the main sources of timber are National Forest System and Native corporation lands. By regulation, timber harvested on federal land undergoes primary manufacture into products such as pulp, lumber, or chips unless otherwise authorized by the Regional Forester. There are exceptions to this rule. For example, Alaska cedar was determined to be in excess of domestic needs, and under permit, may be exported as unprocessed logs. Western redcedar logs may be exported by permit until such time as a competitive market exists. Timber harvested from private lands may be exported as unprocessed logs.

Log raft being transported.

As indicated by the data presented in Table SE-4, the timber harvest in Southeast Alaska fluctuated in the 1980s and 1990s. One of the primary reasons for the fall in timber harvest in the early to mid-1980s was the precipitous increase in the value of the dollar. This resulted in reduced overseas demand for Alaskan timber, and therefore, reduced production. A clear correlation, presented in Table SE-4, can be drawn from the reduction and subsequent increase in timber harvest to timber industry employment data throughout the 1980s. Future timber harvest on Native corporation lands will decline substantially as timber inventories are depleted.

Table SE-4
Timber Harvest in Southeast Alaska by Source (MMBF Log Scale)

Source	FY83	FY84	FY85	FY86	FY87	FY88	FY89	FY90	FY91
Tongass NF	220.0	226.7	162.5	251.4	282.0	331.5	377.0	399.0	299.6
Native Corp.	249.3	202.3	225.3	295.9	286.1	286.4	419.8	441.7	318.8
Other	24.9	18.0	4.3	12.2	19.5	16.8	14.9	11.1	11.5
Subtotal	**494.2**	**447.0**	**392.1**	**559.5**	**587.6**	**634.7**	**811.7**	**851.8**	**629.9**
Imports	21.1	5.7	7.8	24.4	5.7	0.1	1.8	1.2	0.0
Total	**515.3**	**452.7**	**399.9**	**583.9**	**593.3**	**634.8**	**813.5**	**853.0**	**629.9**
Utility	84.4	122.5	131.0	98.1	179.3	186.0	177.6	140.4	197.1

SOURCE: USDA-Forest Service 1992.

Alaska's timber industry is primarily dependent on export markets in Japan, and to a lesser extent, other Pacific Rim countries including Taiwan, Thailand, Indonesia, South Korea, and the People's Republic of China. For instance, within the past year, the value of pulp has increased to well over 50 percent, due to a boll worm epidemic in China. The epidemic virtually wiped out China's cotton crop, resulting in an increased demand for rayon which is made from wood pulp. Domestic markets are important as well; mills in Southeast Alaska ship timber to each coast and midwestern states. Alaska's major competitors in the export market are British Columbia, Pacific Northwest states, Russia, and New Zealand. The fortunes of the timber industry of Southeast Alaska are closely tied to the yen and dollar exchange rate, a stable Japanese market, and housing starts in Japan. Thus, a constant supply of Tongass timber is not the only factor controlling timber employment.

Timber Related Employment

The Tongass timber program is part of a long-term effort to provide greater economic diversity and more stable, year-round employment in Southeast Alaska. To achieve that goal, the Forest Service established requirements to process National Forest timber in Alaska, and entered into long-term contracts to encourage the development of an integrated timber manufacturing industry. These contracts were established under provisions of the Tongass Timber Act of 1947. Providing sufficient timber supply opportunities to maintain timber-related employment in Southeast Alaska was an objective of the TLMP and the 705(a) provision of ANILCA.

Resource industries in Southeast Alaska include wood products, seafood processing, mining, recreation and tourism, and fish harvesting. In Southeast Alaska, the wood products industry accounts for 25 percent of the resource industry employment (TLMP RSDEIS 1996a). From 1980 through 1991, timber harvest and forest products manufacturing supported an average of 4,481 jobs in Southeast Alaska (Table SE-5). During this period, approximately 46 percent of the timber harvested in Southeast Alaska came from land administered by the Forest Service (TLMP RSDEIS 1996a).

Table SE-5
Employment in the Wood Products Industry of Southeast Alaska, Fiscal Years 1981-1991

Employment	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Logging	1,049	991	1,010	946	1,004	1,239	1,545	1,981	2,113	2,144	1,554
Sawmills	605	540	429	395	363	331	375	468	478	500	604
Pulp Mills	1,081	975	854	700	580	772	861	892	925	899	911
Total Direct Employment	**2,733**	**2,506**	**2,293**	**2,041**	**1,947**	**2,342**	**2,781**	**3,341**	**3,516**	**3,543**	**3,069**
Indirect Employment	2,125	1,950	1,800	1,600	1,500	1,825	1,950	2,350	2,550	2,570	2,226
Total Employment	**4,858**	**4,456**	**4,093**	**3,641**	**3,447**	**4,167**	**4,731**	**5,691**	**6,066**	**6,113**	**5,295**

SOURCE: Alaska Department of Labor and USDA-Forest Service Region 10, Planning and Budget.

Two computer simulation models (PASS and IMPLAN) were used to estimate indirect and induced employment. The distinction between direct and indirect employment is a function of the Standard Industrial Classification (SIC) System underlying the collection and grouping of economic statistics. "Induced employment" refers to the additional number of jobs that are supported when employee wages and salaries are spent locally. Direct employment provides the best indication of the growth of an individual industry, while the sum of all three categories is a better indication of the significance of any one industry to the region's economy.

Economic Efficiency

The harvesting of timber involves large investments. The economic efficiency of these investments is relevant to the choice among environmentally different alternatives being considered and can be addressed in three ways. First, the economic efficiency of alternatives will be evaluated. Historic costs for managing, harvesting and processing timber, and historic prices for various timber and wood products are identified and the present net value (PNV) of the alternatives estimated. Second, the timber sales below cost will be evaluated. Third, other non-market and nonpriced issues are discussed. Many of these issues are nonquantifiable within the scope of this project and, therefore, are assessed in a qualitative way. For a comprehensive analysis, these factors must be considered along with the timber economics to determine the net benefit to the nation from timber harvest.

The National Forest Management Act of 1976 (NFMA) set requirements for economic efficiency of forest management proposals. Although the Forest Service has generally tried to achieve cost-effective management (lowest possible input cost per unit of output), systematic evaluation of all costs and benefits from practices and activities has been undertaken only in recent years.

The measure of economic efficiency applied in formulating and evaluating alternatives is Public Net Benefits (36 CFR 219.1(a) and 219.12(f)). Public Net Benefits (PNB) are the sum

of PNV and non-priced commodity values (non-priced benefits (NPB)). Examples of non-priced benefits include scenic quality, wildlife habitat, and community stability. PNV is a method of adjusting revenues and costs to allow their comparison over time. Values of some non-priced commodities are inferred from observations such as the number of participants, tolerance of congestion, and expense of participation.

Sales Below Cost

In response to concerns about the costs and revenues from timber sales on National Forest lands, especially sales where costs exceeded revenues, the General Accounting Office (GAO) and the Forest Service, at the direction Congress, jointly developed the Timber Sale Program Information Reporting System (TSPIRS). TSPIRS reports are designed to describe financial and economic aspects of the forest-wide timber sale program. Managing timber is a long-term commitment of land and resources and a variety of activities occur each year on stands at various ages in their rotation. For this reason, many of the costs, such as roads and reforestation, are pooled and then redistributed over a series of years based on the amount of timber harvested. This is a different approach than is used in the calculation of PNV descibed above where costs are measured in the year they occur and discounted back to the present.

While the system was designed for forest-wide purposes, it can be adapted to provide some insight into the below-cost sales for areas smaller than the entire forest. It will be used in this context to evaluate the relationship of the alternatives to the sales below cost issue.

Large development costs usually accompany new timber sales. These costs in turn translate into revenue for local businesses, and employment and income for local people. The TSPIRS reports provide a description of the extent of investments in timber harvesting on the Tongass National Forest. The Tongass National Forest had revenues in excess of expenses of almost $190,000 in 1988, $2.5 million in 1989, and $11.5 million in 1990. For this 3-year period, average revenues were slightly over $200 per thousand board feet. Total controllable expenses averaged about $74 per thousand board feet, payments to the State averaged almost $43 per thousand board feet, for an average net gain of about $85 per thousand board feet.

Receipts and Payments

In all years, except 1987, 25 percent of all revenues received (including purchaser road credits) from the Tongass was paid to the State of Alaska. The 1980 to 1994 average payment to the State of Alaska was $4,782,000, and in 1994 the amount was $8,726,000 (TLMP RSDEIS 1996a). The funds are used to benefit public schools and public roads. The amount of funds contributed in the past have not comprised a significant portion of the total public schools and public road budgets for the cities and boroughs of Southeast Alaska. However, changes in these payments are of considerable interest to local residents.

Commercial Fishing Industry

Although the commercial fisheries industry in Southeast Alaska continues to fluctuate, it remains a major component of Southeast Alaska's economy. Salmon stocks recovered from their low levels in the early 1970s. Alaska's commercial fisheries have become increasingly regulated. In the case of salmon, a permit system regulates the number of harvesters accessing the fishery. Harvest of halibut is regulated through Individual Fish Quotas (IFQs). Seafood processing, also a vital component of Southeast Alaska's economy, has undergone some changes since 1980. Of major significance were an increased use of floating fish processing facilities and a trend toward frozen rather than canned salmon.

Salmon continues to dominate the industry, both in volume and value of catch, and in harvest-related employment. The labor force and employment associated with fishing is highly seasonal. The TLMP RSDEIS (1996a) estimates suggest that 60 percent of the fish used by the fish-processing industry are salmon. National Forest habitats produce salmon harvested in Southeast Alaska fisheries. Assuming habitat is proportional to ownership of timberland in Southeast Alaska, it is estimated that the Tongass National Forest may contribute up to 80 percent of the regional salmon harvest. Consequently, 48 percent of the seafood processing employment was identified as being dependent upon the National Forest (see Table SE-3). Anadromous fish-rearing habitat on the National Forest Lands in Southeast Alaska likely supports 1,500 jobs in salmon harvesting and 790 in the fish processing sectors. It is estimated that 9 percent of the region's population depends on the harvest of salmon spawned in the National Forest in Southeast Alaska. Individual communities may have a higher degree of dependence. Additionally, for some families, commercial fishing and processing work provides an income supplement rather than their principal source of earnings. For other families, income from fishing or cannery work is the only cash supplement to an otherwise subsistence lifestyle.

Recreation and Tourism

Alaska's recreation and tourism industries are driven by both visitors and residents. While visitors and residents demand different services, and spur different economic impacts, the foremost commonality of these groups is the increase in their size. The resident population of Southeast Alaska and the numbers of visitors to the state have been increasing (Alaska Department of Labor 1996, Alaska Department of Commerce and Economic Development 1994).

The Alaska Department of Commerce and Economic Development compiles statistics on arrivals into the state for residents and visitors during the summer months. From 1985 through 1994, they have documented a trend of steady growth. "Since 1985, total arrivals have increased by two-thirds." The summer of 1994 (June to September), brought 1,139,874 people to the state. Approximately three-quarters of all arrivals to Alaska during the summer months are visitors; this composition has been fairly consistent since 1985 (Alaska Department of Commerce and Economic Development 1994).

The Alaska Department of Natural Resources prepares a Statewide Comprehensive Outdoor Recreation Plan (SCORP) every 5 years. This report focuses more on the recreation needs of residents of the state. By nearly a 2:1 ratio, Alaskan's favorite activity is sport fishing, followed by hiking, hunting, camping, and winter sports.

> *"Approximately 95 percent of Alaskans consider the availability of high quality outdoor recreation opportunities to be important to their lifestyle. They demonstrate this importance by their willingness to purchase outdoor recreation equipment."* (Alaska Department of Natural Resources 1993)

Between 1979 and 1991 (the last time a statewide recreation survey was conducted), participation rates for most activities increased (Alaska Department of Natural Resources 1993). The SCORP identifies the need for "basic facilities" in Southeast Alaska to meet the recreation needs of the resident population. "Trails were the most significant facility need in Southeast. . . by a 3:1 ration over other facilities."

During the 1980s, the tourism industry became a major force in the economics of Southeast Alaska. Cruise ships traveled the Inside Passage, making regular stops at Southeast Alaska ports in record numbers. Newer and larger capacity ships, as well as smaller ships tapping special interests, are ushering a new era of tourism to Southeast communities.

While the economic impacts of this industry are likely to increase, they are not felt throughout the communities in the Chasina Project Area, but are currently confined to the immediate vicinity of Ketchikan. The visitor season currently runs from May through September. Cruise ship passenger numbers visiting Ketchikan have grown from 85,000 passengers in 1981, to 378,645 in 1995.

According to the State of Alaska, the Inside Passage was the most visited attraction by all visitors to the state in 1993. The second most visited attractions by pleasure visitors (as opposed to business visitors, etc.) were the totems located in Ketchikan (Department of Commerce and Economic Development 1993).

During the summer of 1993, visitors spent $597.9 million in Alaska (Department of Commerce and Economic Development 1993). "Tourism is now the State's second largest private sector employer, directly employing an annual average of 10,300 workers who earn an estimated $186 million in annual payroll" (Alaska Department of Natural Resources 1993). These jobs, however, are typically low paying and seasonal.

General recreational use and tourism within the Tongass has more than doubled in the last 10 years. This, in turn, reflects a rapid increase in recreational and tourism related activities (including sport fishing and hunting) and now accounts for an estimated 2,771 direct employment jobs (TLMP RSDEIS 1996a). This figure constitutes 7 percent of Southeast Alaska total 1994 employment.

Sport Fishing

The *Southeast Alaska Sport Fishing Economic Study* (1991), a research report done for the State of Alaska, contains Ketchikan Area data:

> *"In 1988, anglers spent $83.1 million for sport fishing in Southeast Alaska. Resident anglers spent about $40.7 million and nonresident anglers spent about $42.4 million. Ketchikan area resident anglers spent about $6.6 million on sport fishing. For nonresident anglers, sport fishing in the Ketchikan area generated the most spending, comprising about $13.7 million, or 32 percent of all nonresident angler spending."*

Of all species sought by residents and nonresidents, king salmon generated the most spending, accounting for $13.3 million, or about 32 percent of all resident angler spending, and accounting for $9.6 million, or 23 percent of all nonresident spending. This has important significance for the local charter fleet.

It was estimated that in 1988, angler spending contributed toward the generation of $1.5 million in local sales tax revenue, $105,000 in lodging tax, $135,000 in state corporate income tax, and $1.2 million in fishing license revenues. For nonresident anglers, fisheries in the Ketchikan Area are the most valued throughout Southeast Alaska, with an annual "willingness-to-pay" value of $7.5 million. The willingness-to-pay concept can be described as a value which approximates market price.

Clover Bay Floating Fish Lodge is located just north of the project area. They average 20-24 guests, who fish for halibut and salmon from June to mid September. Much of their fishing effort is in the ocean around the project area.

Sport Hunting

The primary big game species in Southeast Alaska and the Ketchikan Area, in terms of number harvested and hunter participation, is the Sitka black-tailed deer. Deer constitute over 90 percent of the total big game harvest in Southeast Alaska (Doerr & Sigman 1986). Estimating value using the willingness-to-pay concept (the amount hunters are willing to pay to harvest a deer) places deer hunting by resident Southeast Alaskans at $332 (Swanson, Thomas & Donnelly 1989). Hunting expenditures are not available for the Ketchikan Area.

An estimated 285 jobs in Southeast Alaska depend on the expenditures made by hunters. About 820 jobs in the region result from the purchases of sport anglers. Another 475 jobs result from the purchases made by businesses and their employees. In total, hunting- and fishing-related expenditures (excluding commercial fishing expenditures) produce approximately 6 percent of the region's wage and salary employment (Forest Service 1990b).

Non-market/Non-Priced Values

A discussion of the relationship between an economic benefit to cost analysis and the analysis of unquantified environmental effects, values, and amenities is useful in considering project alternatives. In Forest Service terminology, three types of values are typically considered in economic evaluations: market values, non-market values, and non-priced values. Market values are those established through a market, such as timber. Non-market values are those that can be quantified using economic techniques that infer or deduce values which might prevail if a market were present, such as some types of recreation. These first two types are included directly in the benefit to cost analysis. Non-priced values refer to those for which it is impossible to quantify a value, even with non-market economic techniques, such as the value of religious sites or genetic diversity.

Non-market Values

Recreation, fish, and wildlife values are not typically established by a market but are important considerations in making resource management decisions. Wildlife viewing and photography are some of the most popular activities among forest visitors. A survey of businesses which provide products and services for wildlife viewing, wildlife photography, and other non-consumptive wildlife uses indicated that this use is rapidly increasing in Southeast Alaska (Shea 1990). It is estimated that over 200 businesses in Southeast Alaska provide wildlife viewing recreation services. This business activity is growing as much as 33 percent annually, with client expenditures contributing substantially to the economy (Shea 1990).

Non-market values can be applied to changes in the levels of some recreation, fishing and hunting activities associated with the alternatives to estimate the economic value of these changes. These values can then be incorporated into a benefit to cost analysis and a below-cost sales analysis.

Non-Priced Values

There are many other values, called non-priced values, that people hold for which markets do not exist and to which market values cannot be attached. Among others, these include active

use values (subsistence), the value of the forest as habitat for wildlife, and passive use values. Passive use values include existence, option, and other non-use values (Mitchell and Carson 1989).

Some important non-priced values are visual quality, diversity and quality of recreation opportunities, old-growth retention, suitable habitat for threatened and endangered species, and cultural resources. Another is the value of retaining old-growth forest and wilderness or semi-wilderness areas. This represents the value that people, who will never visit the project area, receive from the knowledge that the area exists and the condition (or perceived condition) in which it exists. This value can be inter-generational since timber cuts conducted in the 1990s will be visible for one human generation. Recent work in this field was conducted following the Exxon Valdez oil spill in Prince William Sound, Alaska. Quantitative studies were conducted to determine prices for values and were based on people's willingness-to-pay to avoid habitat degradation. Such surveys, which must be conducted on a national or international basis, are beyond the scope of this project and have not been conducted for the Tongass as a whole. It should be noted that contingent values can be quite high. Those arrived at for the oil spill study determined that the people of the United States were willing to pay about $3 billion to avoid the oil spill (Carson et al. 1992). It is evident that similar values exist for the Tongass because of the concern expressed by some conservation and preservation organizations about logging on the Tongass and the reaction to these pressures by Congress.

Judgments are necessary in assessing whether benefits of maintaining non-priced values equal or exceed the trade-offs of producing priced values. While the quantitative dollar values of each cannot be determined, they generally can be examined by association with such quantitative indicators as acres, resource inventories, or timber production related activities and outputs.

Effects of the Alternatives

Timber Industry

When comparing the economic efficiency of alternative methods that produce similar results, economic analysis is useful. In the case of the Chasina timber sale environmental analysis, each alternative represents a specific management strategy or emphasis to produce 34.1 to 119.7 MMBF of timber harvest. The Forest Service is legally mandated to consider a reasonable range of alternatives for accomplishing a specific project and to analyze the costs and benefits. The rationale in the decision to utilize scarce public natural resources requires balanced and thoughtful deliberation among management actions that affect the quality of the environment. Central to the analysis process is the concept of value, which is represented by the monetary value of the costs and benefits derived from using natural resources. In essence, the Forest Service manages a portfolio of public assets. By selecting a specific course of action, the Forest Service uses capital in the form of stumpage value or the value per acre of logs to help defray forest development expenses.

People in Southeast Alaska rely on the availability of natural resources from the Tongass National Forest. Their economic well-being and livelihood are inextricably tied to these resources. The Forest Service is required by the National Forest Management Act (NFMA 1976) regulations implementing NFMA, and Forest Service policy and manual direction, to

perform economic efficiency and economic equity or distributional analysis as part of the National Environmental Policy Act (NEPA) process. Economic efficiency is concerned with getting the most output for each dollar spent. Economic equity is concerned with who benefits (jobs, tax base) and who pays because of economic transactions. Forest Service officials are not required to select the alternative that is the most economically efficient. However, they must carefully consider the level of investment required to implement each project and alternatives within projects to determine how to provide the outputs defined by the Forest Plan with the least expenditure of dollars. The purpose of this analysis is to provide the information needed to make informed economic decisions.

Economic Evaluation of Timber Harvest

The measure of economic efficiency applied in formulating and evaluating alternatives is Public Net Benefits (PNB) (36 CFR 219.1(a) and 219.12(f)). PNB is the sum of Present Net Value (PNV) and non-priced commodity values. PNV is the difference between the discounted value of all outputs to which monetary values or established prices are assigned and the total discounted costs of managing the area. Examples of non-priced benefits include scenic quality, wildlife habitat, and community stability.

Direct and Indirect Effects

The economic impacts of the Chasina Project Area alternatives can be evaluated in a number of ways. The value of the standing timber is equivalent to its "stumpage value", or the amount of compensation the Forest Service receives when the timber is harvested. In addition to returns to the U.S. Treasury, stumpage values indirectly affect fiscal conditions in local communities through payments to the State. The concept of PNV is useful in analyzing investments in timber harvest activities and capturing the benefits and costs that are realized over a period of time. The benefits of future harvest revenues are offset by their costs and combined with the costs and revenues of the initial harvest to calculate a PNV for each alternative. From a social welfare perspective, the volume of timber available for harvest under each alternative supports a different level of job opportunities in timber-related industries. A more detailed analysis of these important economic indicators is included in the following discussion.

Mid-market Assessment

Determining the economic feasibility of each timber sale offering is an important step in the Forest Service planning process. Forest Service policy and handbook direction (FSH 2409.18) requires an economic efficiency assessment to compare benefits and costs of each proposed timber sale project (a mid-market assessment) and a determination if the sale would be a positive economic offering. This economic efficiency analysis is performed by comparing expected gross revenues to estimated costs and arriving at an estimate of future net revenues. To account for market fluctuations, weighted average timber values over the past 10 years are used in the analysis.

Logging costs vary by volume class (indices of the average quantity of timber per acre) mainly due to the size of the logs yarded. In general, the higher the volume per acre, the larger the logs; thus, the logging costs per thousand board feet (MBF) are lower. Species composition is an important variable to consider when estimating timber value. For example, Volume Class 4, which has the lowest average volume per acre, often contains a large proportion of yellowcedar that is exportable in log form and has high pond value. Pond value is the value of the logs at the mill, minus manufacturing costs. For the Chasina Project, this assessment was conducted by subtracting estimated logging and transportation costs (including road

construction) from the pond log value for each action alternative. To account for market fluctuations, the weighted average of quarterly pond log values from 1985 through 1995 was used in the analysis. An allowance of 60 percent of normal profit and risk was also included as a cost and subtracted from pond log values per FSH 2409.18. This assessment, therefore, estimates the value of the timber that would accrue under average market conditions.

Table SE-6 displays the results of a mid-market assessment and the relative economic performance of each timber harvest alternative. It is important to recognize the limitations of the mid-market assessment approach; namely, the values represent very preliminary approximations of future timber sale revenues and costs. Prior to the time each geographic area within an alternative selected for implementation is offered, each unit and road will be cruised by the Forest Service to accurately determine the quantity, quality, and value of timber. A formal appraisal and timber sale report will be prepared incorporating current quarter selling values and cost information, plus a normal profit and risk margin using the assumption of and operation of average efficiency as required. Site-specific environmental investments, such as reforestation of yellowcedar by hand planting in clearcut units for example, will be included in K-V sale area improvement plans, timber sale appraisals, and contracts. The purpose of this appraisal is to determine the minimum acceptable selling value for the sale or offering. Current selling values have increased in response to market demand for Southeast Alaska logs; however, costs also have increased.

Table SE-6
Summary of Estimated Costs and Profits by Alternative—Mid-market Analysis

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Total Volume (MBF)	0	34,086	55,028	84,806	64,393	119,698
Roads, New and Reconstruction (Miles)	0	19.7	50.7	31.0	44.7	75.3
Pond Log Value ($/MBF)	0	332.22	332.22	332.22	332.22	332.22
Logging Costs ($/MBF)	0	194.06	168.06	218.93	180.73	190.27
Haul Costs ($/MBF)	0	32.49	29.57	29.73	30.33	32.96
Administration Costs ($/MBF)	0	10.48	10.48	10.48	10.48	10.48
Temporary Development Costs ($/MBF)	0	4.28	5.16	4.28	6.05	5.17
Specified Road Costs ($/MBF)	0	59.44	118.80	39.84	87.27	89.81
Specified Road Reconst. Costs ($/MBF)	0	2.28	1.41	1.37	1.80	.97
Total Harvest Costs ($/MBF)	0	303.03	333.48	304.63	316.66	329.66
60% Normal Profit and Risk ($/MBF)	0	52.64	52.64	52.64	52.64	52.64
Net Stumpage Value ($MBF)	0	-23.45	-53.90	-25.05	-37.08	-50.08

SOURCE: USDA-Forest Service

Note: Volume does not include right-of-way.
Values are meant for comparative purposes only.
All transportation costs include all costs not associated with capital investments or costs normally connected to road construction, such as: fall, buck, yard, sort, load, haul, dump, raft and tow.
All construction costs include costs associated with LTF development, road construction, and reconstruction, such as: pit development, clearing, grubbing, embankment, haul, excavation, and related material, such as bulkheads, bridges and culverts.

Examination of Table SE-6 shows that net stumpage values are highest for Alternatives 2 and 4, with Alternative 5 slightly lower, and Alternatives 3 and 6 ranking substantially lower, although all are negative. Alternative 4, which emphasized helicopter logging, outperformed Alternatives 3, 5, and 6 in terms of net stumpage.

Logging costs include all cost centers used in the Region 10 appraisal process to harvest timber. Common to all alternatives are timber falling, bucking, yarding, sorting, and loading. Long-term values have quarterly adjustments to reflect market conditions. The Forest Service uses the assumption of an operator of average efficiency to appraise timber sales. A more efficient operator could perform the sale and avoid a negative net stumpage.

The Forest Service also recognizes that appraisals represent a photograph of a point in time and that changes in market demand can impact future sale offerings. Increased selling prices for forest products translate into improved pond values with the result that marginal stands, in terms of their economic operability, could be harvested at a profit. Comparing each

alternative with the current log pond values indicates that all alternatives are projected to yield significantly higher positive net stumpage values (Table SE-7). Comparison of the mid-market analysis with the current-market analysis indicated that this particular sale area may not be saleable under depressed or falling market conditions, but would be saleable under rising or favorable market conditions.

Table SE-7
Summary of Estimated Costs and Profits by Alternative—Current-market Analysis

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Total Volume (MBF)	0	34,086	55,028	84,806	64,393	119,698
Roads, New and Reconstruction (Miles)	0	19.7	50.7	31.0	44.7	75.3
Pond Log Value ($/MBF)	0	529.00	529.00	529.00	529.00	529.00
Logging Costs ($/MBF)	0	194.06	168.06	218.93	180.73	190.27
Haul Costs ($/MBF)	0	32.49	29.57	29.73	30.33	32.96
Administration Costs ($/MBF)	0	10.48	10.48	10.48	10.48	10.48
Temporary Development Costs ($/MBF)	0	4.28	5.16	4.28	6.05	5.17
Specified Road Costs ($/MBF)	0	59.44	118.80	39.84	87.27	89.81
Specified Road Reconst. Costs ($/MBF)	0	2.28	1.41	1.37	1.80	.97
Total Harvest Costs ($/MBF)	0	303.03	333.48	304.63	316.66	329.66
60% Normal Profit and Risk ($/MBF)	0	71.66	71.66	71.66	71.66	71.66
Net Stumpage Value ($MBF)	0	154.31	123.86	152.34	140.68	127.68

SOURCE: USDA-Forest Service.

Note: Volume does not include right-of-way.
Values are meant for comparative purposes only
All haul costs include all costs not associated with capital investments or costs normally connected to road construction, such as: fall, buck, yard, sort, load, haul, dump, raft and tow.
All construction costs include costs associated with LTF development, road construction, and reconstruction, such as: pit development, clearing, grubbing, embankment, haul, excavation, and related material, such as bulkheads, bridges and culverts.

The market fluctuation between the mid-market analysis (NOI-November 1995) and the current-market analysis (March 1996) is an approximate increase of 37.2 percent in pond log value. This increase resulted in all alternatives showing a net gain indicating that all discounted direct costs associated with timber harvest were less than the discounted direct value of the benefits (pond log value).

Table SE-7 shows that Alternatives 2 and 4 have the most potential for profit due to having the least amount of road to build versus number of harvest units accessed. Alternatives 3 and 6 have more road to build to access increasingly more difficult and isolated harvest units and

show a decreasing potential for profit. The calculated net stumpages are indicative of comparative profitability rather than the magnitude of potential profitability.

Variances in volume per acre, species mix, logging systems, log-haul distance, road construction and reconstruction costs, camp mobilization costs, and profit and risk allowances affect logging, transportation, and construction costs for each alternative. Costs and revenues used in the assessment represent averages for each alternative. Although individual units, or even entire sales, may not be economical to harvest by themselves, the management of less productive lands or lands containing a high percentage of defective timber will help to increase future timber yields. The harvest of units with higher returns will help compensate for those that are less economical.

The major factor affecting net stumpage values among the action alternatives are haul costs and the cost of specified roads. Alternatives with longer average haul distances and more miles of road construction yield the lowest net stumpage values. Alternatives that concentrate harvest in VCUs with existing road systems proposed shorter haul distances and require less road construction as well as yield higher net stumpage values. There is a direct relationship between the extent of helicopter yarding proposed for an alternative and increases in stump-to-truck costs. The cost increases, however, may be offset by lower costs for hauling and road construction costs.

Timber Related Employment

Each alternative will affect the number and composition of timber-related employment within the communities in the primary region of influence which is the Ketchikan and Prince of Wales Area.

In estimating employment impacts it is assumed that other supply and demand factors affecting markets for forest products and uses remain constant; however, assumptions lose validity as time frames are extended. For example, the amount of timber offered for sale within the project area is not the only factor that affects the number of wood products industry jobs. Other factors include the supply and demand for wood products and the subsequent number of employment opportunities, worker productivity, interest rates, import and export levels, production and shipping costs, competition, and other landowner harvest levels and policies.

Total timber-related employment is based on an estimated 5.71 total jobs per million board feet, as developed by the computer simulation model IPASS (developed for the Forest Service to analyze the effects of agency management initiatives and investments on employment and earnings in Southeast Alaska). Table SE-8 displays timber related jobs estimated to be made available per alternative.

Table SE-8
Projected Timber-Related Employment and Yearly Incomes by Alternative*

	Number of Jobs					
Proposed Harvest Year	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
1998	0	18	31	45	35	66
1999	0	53	89	128	102	190
2000	0	55	93	134	106	198
2001	0	78	131	189	149	278
Avg. Annual Number of Jobs	0	51	86	124	98	183

	Yearly Earning					
Proposed Harvest Year	**Alt. 1 (M$)**	**Alt. 2 (M$)**	**Alt. 3 (M$)**	**Alt. 4 (M$)**	**Alt. 5 (M$)**	**Alt. 6 (M$)**
1998	0	1.07	1.84	2.68	2.08	3.93
1999	0	3.15	5.30	7.62	6.07	11.31
2000	0	3.27	5.53	7.97	6.31	11.78
2001	0	4.64	7.79	11.38	8.87	16.54
Avg. Annual Earnings	0	3.01	5.12	7.38	5.83	10.89
Estimated Total Earnings	**0**	**12.14**	**20.47**	**29.51**	**23.32**	**43.55**

SOURCE: USDA-Forest Service

Note: M$ = millions of dollars
* includes right-of-way volume in addition to proposed harvest unit volume.

Alternative 1 proposes no timber harvest and could result in a decline in timber-related employment should the mill not be able to substitute volume from another source. The effects of Alternative 1 are not predictable and could range from elimination of shifts to a partial or even a full short-term shutdown in addition to the potential loss of revenue.

Possible long-term ramifications of Alternative 1 could be the destabilization of the wood products industry which will affect the Primary and Extended ROI. This assumes that no replacement timber harvest projects are cleared through the NEPA process for offer beyond 1996, although several are pending.

Long-term impacts on timber employment on the Ketchikan Administrative Area are a function of the Forest Plan, and the analysis in the TLMP Draft Revision (1991a) is

incorporated by reference. The primary effect of any of the action alternatives would however be maintenance of current employment levels.

Economic Efficiency

Historically, the timber market has been cyclic, with sharp peaks and valleys in pond log values. A modest change of a few dollars per thousand board feet can result in significant shifts in the economic supply of timber. The present net value yardstick reflects historical average conditions for both prices and costs, and may not represent the economic viability of the project area in any given year. Break even values, a pond log value that would be necessary for the discounted benefits to just equal the discounted costs, are shown in Table SE-9. These values would fall roughly into the top one-fourth to one-third of historical prices for Tongass National Forest timber.

Table SE-9
Estimated Break Even Pond Log Values for Mid-market Analysis

	Alternatives				
	Alt. 2	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
Pond Log Values ($/MBF)	355.67	386.12	357.27	369.30	382.30

SOURCE: USDA-Forest Service.

Sales Below Cost

All alternatives show a net loss to the federal government using a mid-market analysis. Market price fluctuations, costs of selling and harvesting timber, and changes in general administrative costs per volume harvested could have different results than these estimates.

Returns to the Federal Treasury

A TSPIRS analysis depicting Federal returns for the Chasina Draft EIS was considered but not performed. TSPIRS was designed to be assessed on an annual basis at the National Forest level for the timber program as a whole, with expenses and costs amortized over the length of the entire rotation (100 years). Furthermore, TSPIRS sums all expenses associated with a timber sale including NEPA prep work, timber inventories, etc. These expenses are then put into a sale or growth activity pool and a percentage is subtracted each year based on how much volume is harvested versus how much remains under contract. Tracking annual project expenses from planning through implementation and final harvest spans several years and is difficult to track on a project-by-project basis. The estimated costs and profits analysis under Economic Efficiency within this section more accurately portrays actual returns to the Federal Treasury.

Payments to State

When National Forest Receipt Act payments change, the borough must compensate with other sources of revenues to maintain the same quality and quantity of school and road

programs. These monies are not always at a stable level and are not 100 percent predictable for use in a budgeting process. Fluctuations have occurred in the past.

Table SE-10 displays the estimated volume harvested, anticipated total timber receipts (including Purchaser Credits for road construction) to the United States government, as well as estimated returns to the State. These estimated returns could be spread out over a 3 to 7 year period depending on the rate of harvest.

Table SE-10
Estimated Returns to State of Alaska

Alt.	Estimated Total Volume (MMBF)*	Estimated Total Receipts**	Estimated Returns to State***
1	0	0	0
2	35	$2,265,200	$566,300
3	61	$7,515,810	$1,878,953
4	87	$4,716,270	$1,179,068
5	69	$6,352,830	$1,588,208
6	128	$12,000,840	$3,000,960

SOURCE: USDA-Forest Service

* rounded to the nearest million board feet including right-of-way.
** based on mid-market rates, timber receipts, and purchaser credits for road construction.
*** for this action only.

Commercial Fishing Industry

Current standards and guidelines and management area prescriptions are expected to limit measurable effects on fish during timber harvest and related activities. There are no substantive changes in commercial fish habitat capability predicted. The direct and indirect jobs attributable to National Forest System lands for the commercial salmon industry should also remain unchanged for all alternatives.

Recreation and Tourism

It is not possible to quantitatively compare priced and non-priced values. Non-priced or non-market values resulting from the proposed action could result in losses due to decreases in "nature" tourism and decreases in societal willingness-to-pay for post-logged landscapes. Due to the limited access of the project area and activities occurring on private ownership, this loss is expected to be proportional to the amount of access gained by implementing an action alternative. However, this loss is expected to be minimal. Benefits or gains would be

realized from employment and profits, government revenues, increased access in the project area, and other factors discussed in this impact statement.

Projections for future employment for Southeast Alaska in the recreation and tourism industries, including employment related to sport hunting and fishing, are a 27 percent increase in use for recreation and tourism, 36 percent for sport fishing, and 53 percent for hunting related jobs during the 1990s (TLMP RSDEIS 1996a). The core community of Ketchikan should on the average reflect these increases but are lower for Prince of Wales Island. Differences between action alternatives should have little overall impact on these projections.

The action alternatives will have no measurable effects on sport fishing jobs. The action alternatives are expected to have no measurable effects on jobs generated by permits for kayak or air charter services due to set standards and guidelines for visual resources. There are no outfitter/guides with current permits or waivers operating within the Chasina Project Area.

Access to the area by plane will remain unchanged. However, access by foot travel and ATVs will increase with implementation of action alternatives. Past experience in adjacent project areas show an increase in sport fishing and hunting due to having a developed LTF and docking facility with a connecting road system. Even though roads are often closed to vehicle traffic, hunters will often boat to LTFs and gain access to a project area by utilizing the road system. ATVs are often used if main roads remain open.

Southeast Alaska Social Environment

Community Stability and Lifestyles

In addition to changes in employment and income, implementation of each of the alternatives will affect other elements of community and individual stability and lifestyles. Elements associated with community and individual stability in this context, reflect the individual and recreational value of the project area and surrounding region, wildlife habitat, and subsistence resources. Detailed discussions of the respective impacts on these resources are presented in corresponding sections of this document.

Community stability is a very important consideration in planning for timber harvest activities on the Tongass National Forest. In addition to values described in preceding discussions (e.g., employment, income, tax receipts), a balance between natural and human resource activities is important to the communities of Southeast Alaska. Many of the residents of Southeast Alaska derive their livelihood from the timber industry or benefit from the economic development the timber industry has brought to their communities. Many residents also participate in a wide variety of activities dependent on the National Forest and/or reside in Southeast Alaska because of its natural setting. As a result, a balance between economic development and an emphasis on non-commodity resources is a desirable objective.

Implementation of Alternative 1 may result in substantial cutbacks in the timber industry's production. The corresponding decrease in timber harvesting and processing employment and income would negatively affect community stability.

Implementation of Alternatives 2, 3, 4, 5, or 6 would maintain a relatively high level of timber harvesting through the Chasina Project implementation period. In general, they would

disperse management activities and tend to bring those areas that have not yet been developed under active timber management within the project area. This may have negative effect on use of the area by people who desire a more natural setting for recreation, subsistence, and other activities. In general, the action alternatives are similar in terms of the level of intensive timber management and their opportunities for non-commodity use. Therefore, differences among the alternatives in terms of projected impacts on lifestyles and community stability would be minimal. However, because of the proximity and visibility of harvest activities to residents of Sunny Cove, Alternatives 2 through 6 could have an effect on these residents' lifestyles. Similarly, Alternatives 3 through 6 could effect residents near the mouth of Cannery Creek due to the proximity and visibility of harvest activities.

Cumulative Effects

The cumulative effects of each of the alternatives on the economic and social environment are quite difficult to estimate. There are a wide variety of factors affecting the employment, income, receipts, population, lifestyle, and community stability of Southeast Alaska. While it is not easy to project the incremental effects of the proposed actions on the project area, there are two facets of long-term timber harvest in the project area that can be addressed.

First, from the standpoint of employment, personal income, population, community services, and community stability, there is substantial benefit to maintaining a consistent level of timber harvest. The receipts generated, including revenue to the U.S. Treasury, payments to the State of Alaska, taxes, and dollars brought into the community, all represent an economic benefit of continued timber harvest activity. The TLMP Draft Revision (1991a) schedules areas for long-term timber harvest activity. The Chasina Project Area is one of the areas scheduled to meet these economic and social needs.

The second facet of a long-term timber harvest that can be addressed is the alteration of the natural environment that takes place when roads are constructed and timber harvested. Some of the economic and social value of Southeast Alaska is dependent on its natural setting. The recreation and tourism industry is based primarily on the natural conditions and scenic quality. As more and more acres of National Forest System Lands and other lands are converted from a natural condition to a managed forest, the activities dependent on and the values attributed to the natural state of the forested land will be affected.

The balance necessary to maintain a viable or even robust economic and social environment is set at a National Forest level, not at a project level. Based on regional standards and guidelines, the action alternatives have been constructed to minimize the negative cumulative effects on the economics and community values of the affected communities when considering the total resource. Cumulative effects on employment are best displayed in the TLMP Draft Revision (1991a), Alternative P. This analysis indicates that for the Ketchikan area as a whole, National Forest System-based timber employment and commercial fishing employment will remain fairly constant, while recreation and tourism employment will increase in the future. Harvesting in the Chasina Project Area is included as part of the overall harvest level assumed as a basis for this projection.

The cumulative effects associated with the proposed timber harvesting alternatives in the Chasina Project Area on the reasonably foreseeable and longer term future of Prince of Wales Island and its surrounding area are expected to take place along three primary aspects.

The first aspect relates to the economic viability of the next entry into the Chasina Project Area. The economic feasibility of helicopter yarding is more greatly affected by market values than cable yarding. Alternative 3 proposes the largest proportion of area for helicopter yarding, 21 percent, while Alternative 3 proposes the least, 9 percent. Alternatives 2, 4, and 5 are intermediate with 14, 19, and 20 percent, respectively.

The ground-verified unit pool of 124 potential harvest units included 903 acres proposed for helicopter yarding out of a total of 4,225 acres or 21 percent. Most of the next entry into the project area would include the remainder of the ground-verified unit pool not harvested under the Chasina Project. This would occur because most of the other suitable-available CFL would still need to be deferred due to adjacency, cumulative visual and watershed effects, and other factors.

Table SE-11 shows the acreage remaining in the ground-verified unit pool after Chasina Project harvest by yarding method for the action alternatives. Helicopter yarding would be required for 23 percent of the remaining unit pool acreage under Alternative 5, and 25, 32, and 27 percent respectively for Alternatives 2, 3, and 4. Alternative 6 would harvest all available cable and helicopter yarding units with this project, leaving no other wood available until harvest units met adjacency requirements.

Table SE-11
Acreage Remaining After Chasina Project Harvest by Yarding Method for Each Alternative

Yarding Method	Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt. 6	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Cable Yarding	3,322	79	2,291	75	1,592	68	971	73	1,514	77	0	0
Helicopter Yarding	903	21	774	25	733	32	363	27	450	23	0	0
Total	**4,225**		**3,065**		**2,325**		**1,334**		**1,964**		**0**	

The second aspect relates to the economic and social benefits of continued harvesting of the proposed volume on Prince of Wales Island. From the standpoint of employment, personal income, population, community services, and some aspects of community stability, there is substantial benefit from maintaining long-term timber harvest in the contract area. The receipts generated, including revenue to the U.S. Treasury, payments to the State of Alaska, State and local taxes, and dollars brought into the community, all represent an economic benefit from continued timber activity.

Based on the timber supply analysis conducted for the Control Lake DEIS, it is unlikely that enough timber is available within the Chasina Project Area and on Prince of Wales Island to

sustain the scheduled timber harvest through the end of the first rotation year in 2054 (when second growth would become widely available for harvest).

The Forest Plan is currently being revised and will contain new estimates of long-term timber supply from the Chasina Project Area and on Prince of Wales Island, and how this will affect communities. The new Forest Plan will update the 10 year sale schedule which will reflect new standards and guidelines, new LUDs, and make adjustments for falldown factors and alternatives to clearcutting.

Table ST-21 in the Silviculture and Timber section of this chapter indicates an estimated 49 percent of Chasina commercial forest lands would still have old-growth forests after decade 6 of forest plan implementation (year 2054). More restrictive land uses would add to this 49 percent old-growth acreage. Similar expectations could be realistic for other Prince of Wales Island geographic areas included in the analysis.

Under falldown scenarios as discussed above, resources that are more dependent on old-growth forest conditions would benefit. Similarly, amenity values related to more natural conditions could benefit. Harvesting that leaves more residual trees (in contrast to clearcutting) will also contribute to a more natural-appearing landscape to the casual forest visitor.

The balance necessary to maintain a viable, robust economic and social environment is established at a national or regional level, rather than at a project level. Cumulative economic and social effects of the proposed alternative actions in the Chasina Project Area must ultimately be assessed in context with coinciding local, regional, and national economic and social developments. Based on regional standards and guidelines, the action alternatives have been constructed to minimize the negative cumulative effects on the economics and community values of the core communities when considering the total resource.

Mitigation

Mitigation measures could be undertaken to improve net national benefits from the project area. This project addresses only timber investment opportunities. All of the action alternatives have a negative PNV. Other natural resource investment opportunities may offer better investment choices and at the same time contribute to mitigating potential community stability goals.

Monitoring

A monitoring plan has been developed for the Tongass National Forest by the Forest Planning Team and is described in the proposed Forest Plan (1991). The Forest Plan contains no specific monitoring goals for socio-economic resources.

Project-specific monitoring that is unique to the Chasina Project Area has been identified for several resources. Project-specific monitoring is not identified for socio-economic resources in the Chasina Project Area.

Subsistence

Key Terms

Alaska National Interest Lands Conservation Act (ANILCA)—requires evaluations of subsistence impacts before changing the use of certain Federal lands.
Birds—includes ducks (e.g., mallards, widgeons, teals, shovelers, old squaws, golden eyes, and buffleheads), seabirds and sea ducks (e.g., scooters, murres, murrelets, puffins, seagulls, and cormorants), Canada geese, seabird eggs, and other birds.
Invertebrates or shellfish—includes king crab, dungeness crab, tanner crab, shrimp, sea cucumber, sea urchins, abalone, octopus, scallops, gumboot, clams and cockles, other invertebrates, and herring eggs.
Land mammals—includes deer, moose, mountain goat, black bear, wolf, small game, and furbearers (e.g., marten and land otter).
Marine mammals—harbor seal and other marine mammals
Nonrural—a community determined by the Federal Subsistence Board to be nonrural. These communities tend to be larger (more than 7,000 people) and more urbanized than other Alaskan communities. Residents of such communities do not qualify for priority use of subsistence resources on Federal lands. Juneau and Ketchikan are the only two non-rural communities in Southeast Alaska.
Fin fish or fish—includes cod, halibut, flounder, sole, flatfish, rock fish, herring, eulachon, hooligan, Dolly Varden, steelhead, trout, and other fish (excluding salmon).
Plants—includes beach greens, mushrooms, roots, seaweed/kelp, and berries.
Rural—a community determined by the Federal Subsistence Board to be rural. Residents of such communities qualify for priority use of subsistence resources on Federal lands. All Southeast Alaska communities other than Juneau and Ketchikan are classified as rural.
Salmon—includes king (chinook), red (sockeye), silver (coho), pink (humpback), and chum (dog).
Subsistence—customary and traditional uses by rural Alaskans of wild renewable resources.
Wildlife Analysis Area (WAA)— a division of land designated by the Alaska Department of Fish and Game and used by the Forest Service for wildlife analysis.

Affected Environment

Introduction

With the passage of the Alaska National Interest Lands Conservation Act (ANILCA) (Public Law 96-487, December 2, 1980), Congress recognized the importance of subsistence resource gathering to the rural communities of Alaska. ANILCA (Section 803) defines subsistence as:

> *"....the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of non-edible byproducts of fish and wildlife resources taken for personal or family consumption; for*

> *barter, or sharing for personal or family consumption; and for customary trade"* (Section 803).

ANILCA provides for *"the continuation of the opportunity for subsistence uses by rural residents of Alaska, including both Natives and non-Natives, on the public lands" (Section 801(1)). It also legislates that "non-wasteful subsistence uses of fish and wildlife and other renewable resources shall be the priority consumptive uses of all such resources on the public lands of Alaska"* (Section 802(2)).

Effective July 1, 1990, the Federal government accepted responsibility for the management of subsistence use of fish and wildlife resources on Federal public lands. This management is regulated by the Federal Subsistence Board. Alaska residents of rural areas or rural communities are given priority in the taking of fish and wildlife on public lands for subsistence uses. In Southeast Alaska, all communities except Juneau and Ketchikan have been determined to be rural by the Federal Subsistence Board.

Many Southeast Alaska residents use natural resources as a base or supplement to their livelihoods. Nearly a third of rural households in Southeast Alaska get at least half their meat and fish by hunting and fishing. Fish and game are widely preferred sources of food among Southeast Alaska households, regardless of their incomes. Examples of major subsistence resources include: deer, salmon, halibut, trout, harbor seals, crabs, clams, waterfowl, and berries (Kruse and Muth 1990).

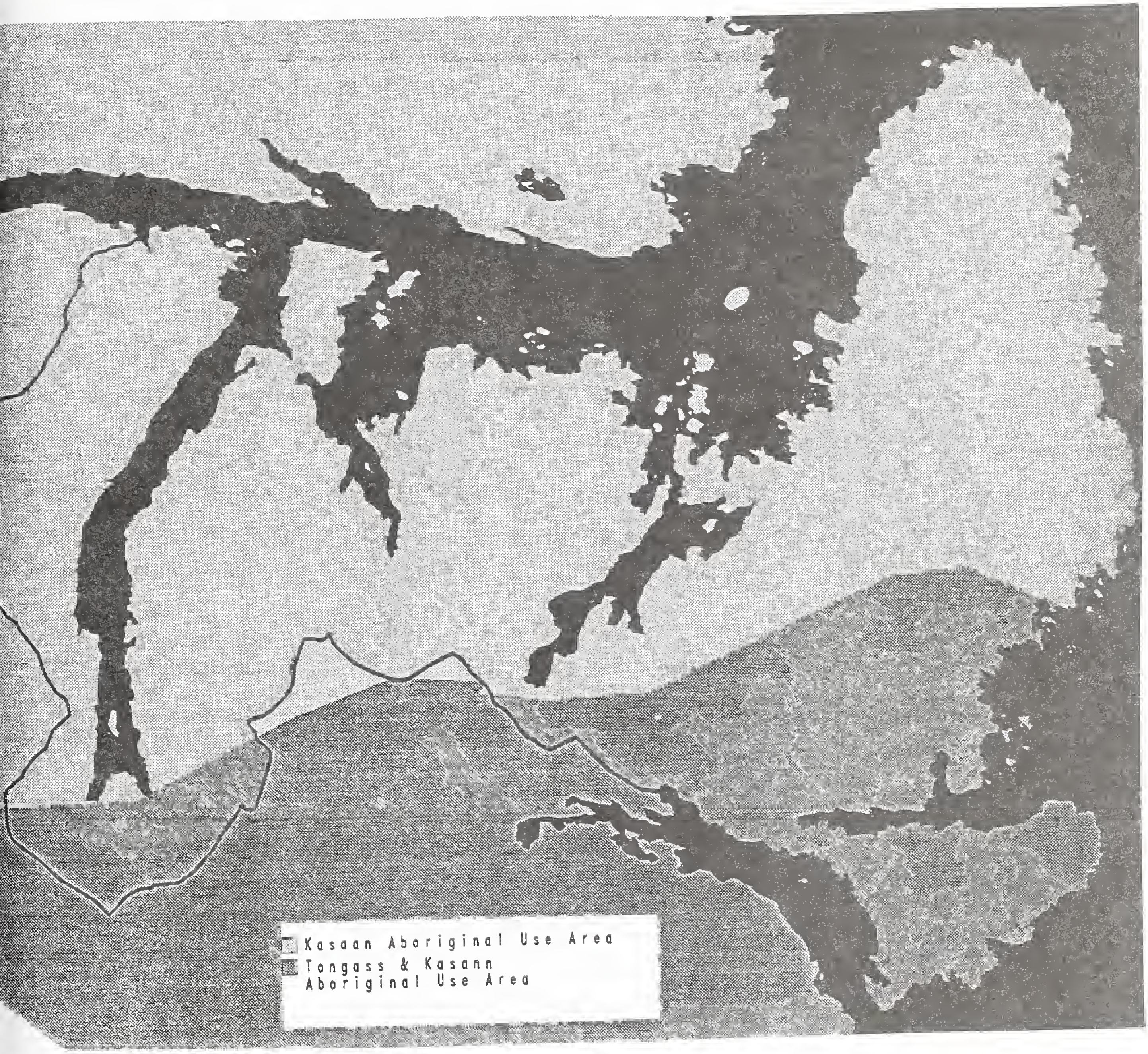
Subsistence activities represent a major focus of life for rural residents. These activities include: hunting for deer, bear, marine mammals, and birds; digging clams; catching fish and shellfish; harvesting marine invertebrates; trapping furbearers; obtaining firewood; and collecting herring and sea bird eggs, as well as edible berries, plants, and roots. Subsistence goods may be eaten, traded, given away, or made into an item of use or decoration.

Even for households that can afford to purchase all their own food, the act of gathering subsistence resources is an important cultural aspect reflecting deeply held attitudes, values, and beliefs. Some traditional foods are not available through any other means than subsistence, and the occasions for gathering wild foods and edible plants often are social events. Historical patterns of movement, such as the annual cycle of dispersal into small family groups at summer fishing camps and then to larger gatherings at protected winter villages, are also linked to the tradition of subsistence gathering. The significance of subsistence activities most often extends beyond the immediate harvest as an embodiment and manifestation of cultural values.

Goldschmidt and Haas (1946) identified the land use patterns associated with Native communities that existed in the mid-20th century in Southeast Alaska. Comparing these maps with information from the 1988 *Tongass Resource Use Cooperative Survey* (TRUCS) maps and ADF&G Subsistence Division maps, it appears that Native hunting and fishing land use patterns are still tied to some extent to historical traditions. Despite the introduction of technological innovations (such as large, modern boats) that would allow residents of Native communities to range much greater distances than in earlier periods, their use appears to be concentrated in locations generally conforming to traditional clan land ownership boundaries. The distribution of harvest locations for non-Native communities, on the other hand, is often likely to range over greater areas.

The Chasina Timber Sale Project Area falls primarily within the aboriginal use area identified for the communities of Kasaan and the Tongass Village (Tongass Tribe) within Ketchikan. (Goldschmidt and Haas 1946, see Figure SUB-1). The aboriginal use area for Kasaan extends from Cape Chacon north to Tolstoi Bay on the east side of Prince of Wales Island. The aboriginal use areas of the Tongass Tribe in this area were Moria Sound, Port Johnson, and Kitkun Bay.

Figure SUB-1
Tongass Village and Kasaan Aboriginal Use Area



The current use areas for these communities, as documented through TRUCS maps, are consistent with the aboriginal use areas, with some modifications. Population consolidation and new settlement patterns are among the reasons for these changes; for example, Saxman as a permanent settlement is outside of the aboriginal Saxman use area. These current community land use patterns are discussed later in this section. Besides Kasaan, the other communities with potential subsistence use within the project area are Hollis, Metlakatla, Craig, Klawock, and Hydaburg.

Average per capita income may or may not indicate the importance of subsistence to a community. While low-income individuals may have a greater dependence on subsistence gathering, individuals with a higher income may simply be in a position to have a more comfortable lifestyle because they combine their subsistence activities with their ability to purchase goods. Higher income does not deter an individual from gathering resources and sharing those with friends and family (Kruse and Muth 1990). Findings from the TRUCS (see below) indicate "members of the highest income group have the highest mean harvest and the lowest mean percent of meat derived from subsistence activities" (Kruse and Muth 1990).

Sharing of subsistence resources is important not only among households within communities, but also with extended families and friends in other areas. This includes sharing with those households that are unable to participate in the harvest of resources. Because some communities have access to resources not found in other communities, sharing of subsistence resources occurs between as well as within communities.

Tongass Resource Use Cooperative Survey (TRUCS)

In late 1987 and early 1988, fieldwork for a detailed subsistence resource and use inventory of the Tongass National Forest was conducted as part of the TLMP Revision. The TRUCS was directed by the University of Alaska's Institute of Social and Economic Research (ISER), in conjunction with the Forest Service and the Division of Subsistence of the Alaska Department of Fish and Game (ADF&G) (Kruse et al. 1988).

In the TRUCS, researchers went to 30 communities in Southeast Alaska and conducted interviews with randomly selected households about their 1987 subsistence uses. As part of the interview, household residents were also asked to indicate on a map those areas used for hunting and fishing. As with more current harvest information (ADF&G hunter surveys), all results are based upon information from samples of households and it is possible that actual amounts harvested by the "typical community household" were either higher or lower than reported by the "typical sampled community household." Craig, Klawock, Kasaan, Hollis, Hydaburg, Saxman, and Metlakatla were included in the TRUCS. Ketchikan, as a non-rural community, was not included in the TRUCs survey because only residents of Alaskan rural communities qualify as subsistence users on Federal lands under ANILCA. The temporary floating logging camps communities also were not included in the TRUCS. A detailed description of the survey is found in the *TRUCS Technical Report Number One* (Kruse et al. 1988).

Recent Project Area Research

There has been no recent research conducted in the project area as a supplement to existing information. ADF&G harvest statistics and other information indicate that the project area is not heavily used for subsistence harvest activities at the present time.
Recent information gathering efforts for other projects suggest that subsistence use of the project area by Saxman residents is probably underreported in the ADF&G statistics.

Resource Management Statistical Units Within the Project Area

Subsistence use is presented for the project area by community in terms of ADF&G Wildlife Analysis Units (WAAs) for deer and other species. These tables point out appropriate study communities, and provide an introduction to a discussion of community subsistence land use patterns. Deer harvest data are available from ADF&G only in terms of WAAs. The project area primarily consists of WAA 1211 with minor amounts in WAA 1210 and 1213.

Table SUB-1
Wildlife Analysis Areas and VCUs Within The Chasina Project Area

WAA	VCUs
1210	682
1211	677, 678, 679, 680, 681
1213	674

SOURCE: USDA Forest Service, Ketchikan Area GIS Data Base.

Documented Subsistence Harvest Activity of Affected Resources Within the Project Area

This section reviews the documented harvest of subsistence resources within the project area. Subsistence use is presented by community in terms of ADF&G WAAs for deer and for other species.

Deer

Table SUB-2 displays the reported total number of deer harvested in each project area WAAs by community, and then the "annual average" number of deer harvested in each project area WAAs by community. The reported information for the project area WAAs is quite sporadic for all communities except Ketchikan; therefore, the "average" statistic should be used only with extreme caution. Table SUB-2 is derived from Table SUB-3 and indicates that reported deer harvest from project area WAAs for Ketchikan is 4 percent of that community's reported harvest and 8 percent for Metlakatla. Ketchikan has historically taken the majority of deer harvested from project area WAAs (80 percent), with no other single community accounting for more than 8 percent. The "other rural Alaska" category includes a large number of communities, none of which has a consistent pattern of harvest over time. This table indicates that the project area is an important harvest area for deer for Ketchikan, and that Ketchikan hunters dominate the overall harvest pattern for the project area.

Table SUB-2
Community Deer Harvest in WAAs 1210, 1211, 1213: 1987 through 1994, Compared to All Areas

Community	1987	1988	1989	1990	1991	1992	1993	1994	Avg.	Community Avg.	%
Craig	-	-	-	-	-	16	-	-	2	594	<1
Hollis	-	8	-	-	-	-	-	-	1	32	3
Hydaburg	-	-	-	-	-	-	-	-	-	48	-
Kasaan	-	-	-	-	-	-	-	-	-	8	-
Ketchikan	70	72	146	63	31	50	62	18	64	1,627	4
Klawock	-	-	-	-	-	27	-	-	3	347	<1
Metlakatla	5	-	2	9	6	-	3	-	3	36	8
Saxman	-	-	-	-	2	-	-	-	0	5	0
Thorne Bay	-	-	-	-	-	-	-	8	1	344	<1
Logging Camps: Cholmondeley	2	-	-	5	-	-	-	-	1	7	14
Skowl Arm/ Polk Inlet	-	-	-	-	-	-	-	2	0	18	0
Long Island	-	-	-	3	-	1	-	-	1	45	2
Other Alaska	-	-	-	18	-	-	-	-	2	-	-
Outside Alaska	-	-	-	3	2	-	2	-	1	-	-
Total	**77**	**80**	**148**	**101**	**41**	**94**	**67**	**28**	**80**		

SOURCE: Derived from data provided by ADF&G Division of Wildlife Conservation.

Note: < = less than; > = greater than

Table SUB-3
Community Total Deer Harvest: 1987 through 1994

Community	1987	1988	1989	1990	1991	1992	1993	1994	Avg.
Craig	761	597	570	634	477	588	635	488	594
Hollis	88	25	6	35	17	25	23	35	32
Hydaburg	112	56	30	39	28	28	27	67	48
Kasaan	10	8	-	-	14	33	-	-	8
Ketchikan	2,005	1,640	1,544	1,738	1,189	1,504	1,465	1,929	1,627
Klawock	313	250	239	295	366	526	307	476	347
Metlakatla	19	43	38	32	35	43	63	14	36
Saxman	18	-	-	11	18	-	-	-	5
Thorne Bay	365	314	349	440	291	367	301	326	344
Logging Camps: Cholmondeley	10	13	2	18	15	-	-	-	7
Skowl Arm/ Polk Inlet	36	37	15	24	12	16	-	2	18
Long Island	24	20	34	43	42	163	33	-	45

SOURCE: Derived from data provided by ADF&G Division of Wildlife Conservation.

Tables SUB-4 and SUB-5 display the relative importance of the project area WAAs in relation to the overall deer harvest in Game Management Unit (GMU) 2 (Prince of Wales Island). Deer harvest in project area WAAs has ranged from 1 to 5 percent of the total harvest in GMU 2. This is most likely a result of the project area being less accessible then other WAAs that are accessible by the Prince of Wales road system.

Table SUB-4
GMU 2 Deer Harvest: 1987 through 1994

1987	1988	1989	1990	1991	1992	1993	1994
3,886	2,849	2,806	3,093	2,466	3,097	2,807	2,825

SOURCE: Derived from data provided by ADF&G Division of Wildlife Conservation.

Table SUB-5
Percent of GMU 2 Deer Harvest in WAAs 1210, 1211, and 1213

	1987	1988	1989	1990	1991	1992	1993	1994
Rural	<1%	<1%	<1%	<1%	<1%	<1.4%	<1%	<1%
Nonrural	1.8%	2.5%	5.2%	2.8%	1.5%	1.6%	2.3%	<1%
Total	**2.0%**	**2.8%**	**5.3%**	**3.3%**	**1.7%**	**3.0%**	**2.4%**	**1.0%**

SOURCE: Derived from data provided by ADF&G Division of Wildlife Conservation.

Note: < = less than; > = greater than

Black Bear

Reported harvest information for black bear is displayed in Table SUB-6. Overall reported harvest is low and is predominately attributable to sport hunters outside of Alaska and Ketchikan hunters. No subsistence community relies upon the project area for black bear. There has been only one black bear harvested in the project area by a qualified subsistence user as defined by ANILCA.

Table SUB-6
Black Bear Harvest in WAAs 1210, 1211, and 1213 by Community, 1988 to 1993

WAA/Community	1988	1989	1990	1991	1992	1993	Avg.
1210							
Ketchikan	1	3	1	1	-	1	1
Metlakatla	-	1	-	-	-	-	<1
Outside Alaska	11	9	10	8	4	-	7
1211							
Ketchikan	1	6	3	4	-	-	2
Other Alaska	-	-	2	-	-	-	<1
Outside Alaska	-	4	1	3	-	2	1
1213							
Ketchikan	-	2	2	3	-	3	1
Other Alaska	-	-	-	-	-	-	
Outside Alaska	4	2	-	3	-	4	2
Total	**17**	**27**	**19**	**21**	**4**	**10**	**16**

SOURCE: Derived from data provided by ADF&G Division of Wildlife Conservation.

Marten

The historical reported harvest for marten in project area WAAs is displayed in Table SUB-7. As for other species, the overall harvest has been low and the pattern over time sporadic. No one area is used on a consistent year-to-year basis and the average number of animals harvested is low. Sixty-eight percent of the annual average harvest of marten was taken by residents from Ketchikan (74 of 109).

Table SUB-7
Marten Trapped in WAAs 1210, 1211, and 1213 by Community, 1988 to 1993

	Trapping Season					
WAA/Community	**88/89**	**89/90**	**90/91**	**91/92**	**92/93**	**Avg.**
1210						
Ketchikan	38	-	-	-	70	22
Craig	-	-	-	-	-	0
Meyers Chuck	-	31	-	-	-	6
Other Alaska	-	-	-	11	-	2
Outside Alaska	-	-	-	-	-	0
1211						
Ketchikan	-	48	24	-	63	27
Craig	11	-	-	-	-	2
Klawock	-	-	14	-	-	3
Thorne Bay	-	-	24	-	16	8
Outside Alaska	-	33	-	-	-	7
1213						
Ketchikan	64	40	23	-	-	25
Other Alaska	-	-	-	44	-	9
Total	**113**	**152**	**75**	**55**	**149**	**109**

SOURCE: Derived from data provided by ADF&G Division of Wildlife Conservation.

River Otter

The reported river otter harvest from project area WAAs has been quite sporadic (Table SUB-8). Average numbers are quite misleading, because most harvest activity in any given area has occurred in relatively few separate seasons.

Table SUB-8
River Otter Trapped in WAAs 1210, 1211, and 1213 by Community, 1988 to 1994

	Trapping Season						
WAA/Community	**88/89**	**89/90**	**90/91**	**91/92**	**92/93**	**93/94**	**Avg.**
1210							
Other Alaska	-	2	-	-	-	-	<1
1211							
Ketchikan	-	-	-	8	-	-	1
Klawock	-	-	12	-	-	-	2
Other Alaska	2	9	-	-	-	-	1
Thorne Bay	-	-	1	5	-	-	<1
Craig	-	-	-	-	-	1	<1
1213							
Other Alaska	1	3	-	-	-	-	<1
Total	**3**	**14**	**13**	**13**	-	**1**	7

SOURCE: Derived from data provided by ADF&G Division of Wildlife Conservation.

Beaver

Table SUB-9 displays the number of beaver harvested in the project area by WAA and by harvest season. It shows that same sporadic harvest as did marten and otter. Most beaver were harvested by Alaskan residents not from the area.

Table SUB-9
Beaver Trapped in WAAs 1210, 1211, and 1213 by Community, 1988 to 1992

	Trapping Season				
WAA/Community	**88/89**	**89/90**	**90/91**	**91/92**	**Avg.**
1210					
Other Alaska	-	-	-	-	
1211					
Ketchikan	-	-	6	-	1
Other Alaska	1	7	-	-	2
1213					
Ketchikan	-	-	5	19	5
Other Alaska	-	7	-	-	1
Total	**1**	**14**	**11**	**19**	**11**

SOURCE: Derived from data provided by ADF&G Division of Wildlife Conservation

Wolf

A majority of the wolf harvest has been by residents of Ketchikan. Only two wolves out of 34 were harvested by a resident of a rural community—Klawock. It appears from Table SUB-10 that the project area WAAs are not important for subsistence use of wolves.

Table SUB-10
Wolf Harvest in WAAs 1210, 1211, and 1213 by Community, 1988 to 1994

	Season						
WAA/Community	88/89	89/90	90/91	91/92	92/93	93/94	Avg.
1210							
Ketchikan	-	-	-	1	1	2	<1
Other Alaska	1	2	-	-	-	-	<1
1211							
Ketchikan	-	-	3	5	2	-	1
Klawock	-	-	2	-	-	-	<1
Other Alaska	1	3	-	-	-	-	<1
1213							
Ketchikan	-	-	1	6	3	-	1
Other Alaska	1	-	-	-	-	-	<1
Total	3	5	6	12	6	2	6

SOURCE: Derived from data provided by ADF&G Division of Wildlife Conservation

Note: < = less than; > = greater than

Salmon

Examination of records kept by ADF&G, Division of Commercial Fisheries showed that during the period of 1985 through 1995, only one subsistence use permit was issued within the project area. It was issued to a residence of Saxman in 1991, and involved the harvest of about 1,000 chum salmon from Disappearance Creek in South Arm of Cholmondeley Sound.

Waterfowl

A variety of species of ducks, along with Canada geese, are hunted in the project area, primarily along bays and estuaries. Goose nest sites typically occur in forested habitat within 600 feet of the forest edge. As broods mature they move from the forest interior to forest edge and intertidal areas. Some parts of the project area were indicated as good waterfowl

harvest locations, but little systematic information is available. There is some indication that areas near fishing sites are those that are best known and used for waterfowl.

Firewood and Lumber

Use of both live and dead timber occurs throughout the project area. Some homes use firewood as the principal heat source because of the great abundance of dead and downed timber. Use of green timber, milled from free-use standing timber, may increase as the local population increases.

Other Uses

Many other subsistence uses of the natural resources occur. Some examples are berry picking, mushroom gathering, use of native plants for arts and crafts, collecting other edible plants and animals, and collecting peat and seaweed for gardens. Most of these activities are not associated with a particular site, but rather occur throughout the project area.

Affected Communities

The communities of Hollis, Metlakatla, Craig, Klawock, Hydaburg, Kasaan, Saxman, and Ketchikan were selected to be analyzed in this document because of their proximity to the project area and/or their identified subsistence resource use of the area. Although Ketchikan is not a "rural" community, it is included because of its importance in terms of documented harvest from the project area and the probable inclusion of Saxman residents with Ketchikan mailing addresses in Ketchikan statistics. The historical underreporting of subsistence harvest and land use activity for Saxman, the close proximity of Ketchikan and Saxman, and the large Native population of Ketchikan also suggest that Ketchikan statistics may—within carefully defined limits—be useful indicators of Saxman land use patterns. The two communities are clearly different in many ways, but it is likely that the near community land use patterns for the harvest of terrestrial mammals is fairly similar (while land use patterns for plant and fish resources are likely to be quite different). Table SUB-11 presents information taken from the 1988 TRUCS report, summarizing the importance of subsistence use for individual communities.

Logging camps and other industrial/commercial sites of a temporary or not primarily residential nature also contribute to the subsistence harvest pattern of activity within the project area. This has been treated primarily though the use of ADF&G harvest data and firsthand knowledge of the nature of such subsistence activity. Much of the "other rural Alaska" harvest activity summarized in Tables SUB-2 through SUB-6 reflects past hunting from temporary logging camps at such locations as Cholmondeley Sound, Skowl Arm, and Polk Inlet.

As mentioned above, fish is the most important subsistence resource for all Southeast Alaska communities. Table SUB-11 displays the per capita harvest of subsistence resources for the study communities (fish taken commercially for home use are included in these figures). For the study communities, salmon and other fish make up 44 to 67 percent of the total community harvest, in terms of edible weight. Shellfish contribute another 11 to 25 percent.

Deer is the most important terrestrial resource in terms of edible weight, and is used here as an indicator species for the complex of terrestrial animal and plant resources harvested as part of the subsistence activity pattern. Phrasing the discussion in terms of fish and deer has the

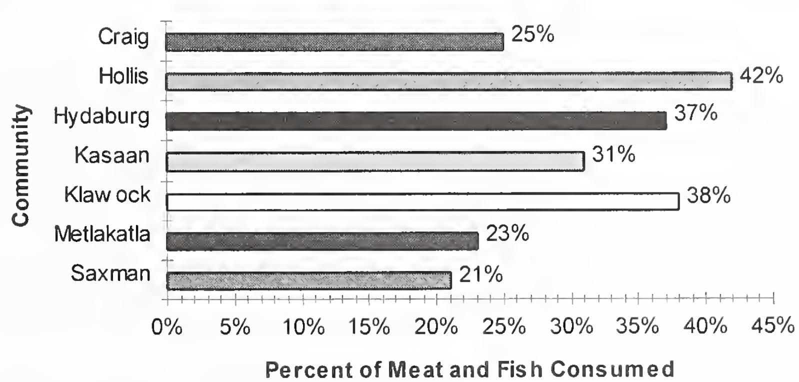
advantage of using resources for which harvest statistics exist and for which models of the effects of timber harvest and some aspects of road construction exist.

Table SUB-11
Per Capita Subsistence Harvest (Edible Pounds for Rural Communities, 1987)

Community	Deer	Other Mammal	Salmon	Finfish/ Marine Invert.	Other	Total
Craig	40.6	3.2	40.4	88.6	12.1	**185.0**
Hollis	37.9	8.7	44.4	63.0	9.9	**163.9**
Hydaburg	42.8	0.6	137.4	135.8	20.4	**337.1**
Kasaan	40.0	2.3	32.0	105.7	5.6	**185.6**
Klawock	34.5	15.5	69.4	95.7	18.2	**223.3**
Metlakatla	10.6	0.2	20.3	32.5	7.2	**70.8**
Saxman	16.6	5.4	33.2	27.9	6.3	**89.3**

SOURCE: ADF&G Community Profile Database Catalog, Volume 1:Southeast Region.

Figure SUB-2
Subsistence Harvest as Percent of Meat and Fish Consumed



SOURCE: Kruse and Muth 1990.

Five of seven communities included in the analysis harvested more than 150 pounds of subsistence resources per capita in 1987 (Table SUB-11). The greatest subsistence users were in Hydaburg with 337 pounds per capita. On average, households in most communities included in the analysis derived one quarter or more of the meat and fish they ate in 1987 from their own subsistence harvest (Figure SUB-2). Hollis residents reported that on average more than 40 percent of their meat and fish came from their own subsistence harvest. Klawock, Hydaburg, and Kasaan obtained 30 to 40 percent of their meat through subsistence harvesting. Craig residents obtained 20 to 30 percent of their meat through subsistence harvesting (Kruse and Muth 1990). The Affected Resources discussion later in this section describes the primary deer harvest use areas for each community, an overall indication of subsistence use areas.

Saxman

The subsistence use of Saxman residents is probably underreported in ADF&G statistics. In general, Saxman hunters tend not to report their harvest. The TRUCS information itself confirms this. The best information on Saxman's harvest is from the 1987 face-to-face interviews conducted for TRUCS. ADF&G hunter survey information since then, which is sent in voluntarily by hunters who receive survey forms, has been quite sporadic.

The same is true for fish, where informants quite clearly indicate that people do harvest a significant amount of fish. Some fish harvesting is associated with commercial operations. At the same time, it is also clear that not all people can harvest as much fish as they would like. The recent program by which the hatchery makes surplus fish available to local Ketchikan and Saxman residents was cited as filling a definite need. That being said, the most frequently identified fishing location is Yes Bay, which agrees with the general distribution of fishing permits. The TRUCS maps for Saxman confirm these patterns. Within the project area, fishing areas identified are West Arm Cholmondeley Sound and around Chasina Point. Saxman residents have harvested chum salmon in the vicinity of Disappearance Creek sporadically (at least once during 1985-1995). While exact information on actual harvest is uncertain, these areas are clearly important for the community of Saxman. It is almost certain that at least part of Saxman's reported harvest is included in statistics for Ketchikan.

Ketchikan

Ketchikan is a non-rural community, and thus, under Federal law its residents are not subsistence users. However, since it is probable that some Saxman residents are included in Ketchikan use statistics, and Ketchikan residents harvest the vast majority of wildlife and fish resources taken from the project area, Ketchikan's use pattern is discussed within the subsistence context. No information exists on whether subgroups of Ketchikan residents have differential patterns of wildlife and fish resource use. Given the indications that Saxman residents use mostly the area close to the community, whereas Ketchikan residents use a very large area, it is likely that there is a subcomponent of Ketchikan hunters/gatherers for whom the project area is more important than for the community user group as a whole.

Overall, the terrestrial resources harvested from the project area by residents of Ketchikan make up a very small part of the total community harvest. This reflects the large number of community hunters, the relative lack of terrestrial resources in the project area in relation to community demand, and Ketchikan residents' ability to access more distant areas where the resources do exist (especially Prince of Wales Island). For fish, the pattern is quite different. Abundant resources exist relatively close to the community. Yes Bay accounts for 30 percent

of Ketchikan personal use/subsistence permits, but provides 58 percent of that community's sockeye catch using such permits (as well as 40 percent of the coho, 59 percent of the pink, and 51 percent of the chum). The Karta River (on Prince of Wales Island) is the other major source of subsistence/personal use fish for Ketchikan. A limited number of permits for other project area streams have been fished. Some Ketchikan users also retain part of their commercial catch for their personal use.

There is no TRUCS map for Ketchikan, since it is a non-rural community. If one were constructed, the project area would not be included in Ketchikan's "high-use" areas, primarily because Ketchikan hunters harvest a great number of deer and project area WAAs do not support a large enough deer population to contribute significantly to this harvest.

The overall pattern for Ketchikan hunters is to use roads and motor vehicles for hunting access, especially on Prince of Wales Island. A limited number of interviews with Ketchikan hunters indicates that there are Ketchikan hunters who hunt more locally (do not use Prince of Wales Island) and who are not primarily road/motor vehicle oriented. They use water transportation and/or rely more on walking.

Craig

While there was aboriginal use of the Craig area for fish camps and settlement sites in the area (most notably at Klawock), the present permanent community of Craig dates from the salmon packing operation started in 1907 on Fish Egg Island, just northwest of the present location of Craig. While Natives comprise a significant portion of the population, Craig is a predominantly non-Native community. This is in sharp contrast with the community of Klawock; however, some residents of Craig are quite similar to those of Klawock in their patterns of subsistence resource use.

Hunters from Craig use WAAs comprising the Chasina Project Area very sporadically. The project area WAAs provide less than 1 percent of the community's overall deer harvest. Craig hunters report using both boats and road vehicles for access to deer hunting areas. There is some indication that boat-based hunters are willing to hike farther than road-based hunters. Overall, Craig hunters report using road corridors most heavily.

Hollis

Hollis reported a low incidence of subsistence use within the project area for all resources. Karta Bay is an important subsistence fishery (Langdon et al. 1992). An average of 164 pounds per capita of edible meat and fish were harvested by Hollis households in 1987. Harvests included an average of 8 different types of subsistence resources. Salmon accounted for 27 percent, deer for 23 percent, finfish other than salmon for 22 percent, and invertebrates for 16 percent of the harvest for Hollis households. Hollis households received an average of 3 types of subsistence resources from other households. Hollis hunters traveled an average of 20 miles to their most reliable deer hunting areas. They were less likely to hunt open beaches, areas that included clearcuts of any age, or areas above the tree line, and more likely to hunt in areas that included old-growth forest, muskeg, roads, or grassy meadows. Hollis residents' reasons for discontinuing deer hunting in an area included the area having been logged, absence of deer, inconvenience, or development (Kruse and Frazier 1988).

Hollis residents harvested an annual average of 32 deer from 1987 through 1994. An annual average of 1 deer was taken in the project area (Table SUB-2).

Hollis subsistence users have historically harvested deer in the areas surrounding Hollis, on Cat Island, along Maybeso Creek, north of the Hollis-Klawock Highway toward Maybeso Creek, along Indian Creek, along the Harris River and southward to Indian Creek, on the Forest Service road north of the intersection of the Hollis-Klawock Highway and the Hydaburg Road, along Hydaburg Road, along the Forest Service road from Hydaburg Road to the southern portion of Twelvemile Arm, and a small area halfway between Twelvemile Arm and Polk Inlet.

Hollis residents did not report taking any black bears, river otters, wolves, or marten from the project area WAAs during the 1988-89 through 1993-94 seasons (Tables SUB-6 through SUB-10).

Hollis deer hunters prefer to hunt their local area. Hollis residents hunt in the Chasina Project Area, but only at a relatively low level. The TRUCS map indicates that those areas used by Hollis hunters are partly outside of the project area.

Hydaburg

Hydaburg subsistence use is dispersed throughout the project area, according to TRUCS maps. The majority of the people interviewed for the Polk Inlet EIS indicated adherence to older subsistence practices oriented to river, oceanic, and island resources located to the west and south of Hydaburg. This type of resource use is done predominantly by skiff and fishing vessel. Some fishing occurs on streams in the area and some users travel to Karta Bay for sockeye harvesting. Hetta Inlet was identified as an important source of shellfish for residents (Langdon et al. 1992).

An average of 337 pounds per capita of edible meat and fish were harvested by Hydaburg residents in 1987 (Table SUB-11). An average of eight types of resources were harvested by residents. Salmon accounted for 40 percent, invertebrates for 24 percent, finfish other than salmon for 16 percent, and deer for 13 percent of the harvest for Hydaburg households. Hydaburg residents received an average of more than nine different types of subsistence resources from other households. Hydaburg hunters traveled an average of 18 miles to their most reliable deer hunting areas. They were less likely to hunt in areas that included roads or clearcuts of any age and more likely to hunt in areas that included muskeg, old-growth forest, open beach, areas above the tree line, or grassy meadows. The most commonly cited reason by residents for no longer hunting deer in an area was that it had been logged (Kruse and Frazier 1988).

Hydaburg residents harvest an annual average of 48 deer, but none in the project area.

The TRUCS map for Hydaburg shows that all of Prince of Wales Island and much of other parts of Southeast Alaska are equally important for deer hunting. Project field interviews support the conclusion that Hydaburg hunters use the project area only in a very limited way. Use of the project area in the future could possibly increase if the road from Hydaburg to Sulzer Portage is completed.

No black bears, wolves, river otters, or marten were reported by Hydaburg residents as taken from project area WAAs.

To some degree, all Hydaburg households rely on subsistence resources for daily food.

Hydaburg residents share substantial amounts of subsistence foods with friends and relatives in other communities. A portion of these resources may be taken from the project area. However, little information exists on the amount of such sharing and the area of origin of the resources shared.

Kasaan

Major subsistence use by Kasaan residents is concentrated on the Kasaan Peninsula with Karta Bay a major focus for salmon and shellfish subsistence harvests. Deer hunting takes place primarily along the Kasaan Peninsula. There are, however, some uses of the South Arm Cholmondeley Sound and along Clarence Strait in the vicinity of Windy Point that are located within the Chasina Project Area. These recreational activities include: bottom fishing, trolling for salmon, crabbing, shrimping, and deer hunting.

An average of 186 pounds per capita of edible meat and fish were harvested by Kasaan residents in 1987. An average of eight different types of subsistence resources were harvested. Invertebrates accounted for 40 percent, deer for 22 percent, and salmon and finfish other than salmon for 17 percent of the harvest for Kasaan households. Kasaan residents received an average of almost six types of subsistence resources from other households. Kasaan hunters traveled an average of 7 miles to their most reliable deer hunting areas. They were less likely to hunt in areas that included roads, clearcuts of any age, grassy meadows, open beaches, or areas above the tree line, and were more likely to hunt in areas that included old-growth forest or muskeg. Kasaan residents were most likely to not hunt in an area because they had no means to get to that area (Kruse and Frazier 1988).

No deer, black bear, marten, river otter, or wolves were reported taken from project area WAAs by residents of Kasaan.

Klawock

Subsistence harvest methods within the community of Klawock have been changing since the road connection with Hollis was made in the 1960s. Prior to that time, subsistence harvest was mostly tied to boating activities. Since road access to the rest of the island has been available to the residents of Klawock, there generally has been a shift from using boats to harvest subsistence materials to using trucks and cars (Ellanna and Sherrod 1987).

Most of the Klawock residents interviewed indicated that their predominant subsistence activities occur in the west coast region of Prince of Wales. A few Native residents have taken their skiffs to Hollis to utilize the Karta Bay fishery and the rich shellfish resources of the Hollis area. This seems to be an increasing trend. Some residents used to hunt on the road system north of Klawock, but declines in abundance have led them to turn to the Hydaburg Road area. They also have returned to using skiffs to hunt the outer islands away from the road system to escape the pressure of hunting by nonlocals on the Prince of Wales road system (Langdon et al. 1992).

An average of 223 pounds per capita of edible meat and fish were harvested by Klawock residents in 1987 (Table SUB-11). An average of eight different types of subsistence resources were harvested by residents. Salmon accounted for 32 percent, finfish other than salmon for 29 percent, deer for 19 percent, and invertebrates for 14 percent of the harvest for Klawock households. Klawock residents received an average of almost five types of subsistence resources from other households. Klawock hunters traveled an average of 35

miles to their most reliable deer-hunting areas. They were less likely to hunt in areas that included open beach, areas above the tree line, or older clearcuts, and were more likely to hunt in areas that included muskeg, old-growth forest, roads, young or middle-aged clearcuts, or grassy meadows. The most commonly cited reason for no longer hunting deer in an area was that the area had been logged (Kruse and Frazier 1988).

An overall annual average of 347 deer were taken by Klawock residents from 1987 through 1994 (Table SUB-3) with an average of three deer taken from the project area. Within the project area, Klawock residents primarily used WAA 1211 with no hunting occurring in WAA 1213.

Klawock residents did not report any black bear harvest within project area WAAs. River otter harvest averaged two per year in project area WAAs (Table SUB-8) and marten harvest averaged three from the project area (Table SUB-7) by Klawock residents.

Metlakatla

Metlakatla is located on Annette Island in southern Southeast Alaska, 15 miles south of Ketchikan. Its population of 1,600 includes 84 percent Alaska Native (Alaska Department of Community and Regional Affairs (ADCRA)).

In 1987, the per capita household subsistence harvest in Metlakatla was 71 edible pounds. Seventy-seven percent of all households harvested some subsistence resource. Most commonly used (by over 50 percent of households) were coho and chinook salmon, halibut, deer, clams, dungeness crab, and berries (TRUCS 1989).

Salmon, halibut, and marine invertebrates accounted for 75 percent of Metlakatla's subsistence harvest; deer was 15 percent. Most of Metlakatla's subsistence activities center around Annette, Duke, and Gravina Islands. Metlakatla residents harvested 8 percent of their deer and one bear in the project area.

Project Area Camps

Several camps exist in or very near the project area. Residents of these camps harvest deer and other wildlife species during their free time.

Polk Inlet Camp

Polk Inlet Camp, established in 1986, is a floating camp with a population of approximately 75 people. It was located at the mouth of Dog Salmon Creek on the west coast of Polk Inlet, and has been moved. The floating camp contains a post office, school, and store and has daily plane service from Ketchikan. It is estimated that over 90 percent of subsistence activities were concentrated in the Polk Inlet area and consisted of deer and salmon harvesting (Langdon et al. 1992). Table SUB-3 shows that the combined camps of Polk Inlet and Skowl Arm harvested an average of 18 deer per year, with most of that harvest occurring before 1993. No black bear, river otter, or marten were reported to have been taken from project area WAAs by Polk Inlet Camp residents during the 1988-89 through 1992-93 season.

Smith Cove (Skowl Arm) Camp

Smith Cove Camp (referred to in ADF&G deer data as Skowl Arm Camp) is a small logging/construction camp of approximately 40 residents located on the northeastern shore of Skowl Arm. The camp is comprised of 15 to 20 mobile home trailers and has a floating store with a

post office. It is likely that a substantial portion of subsistence activities of this camp occurs within the boundaries of the Polk Inlet Project Area (Langdon et al. 1992).

Cholmondeley Camps

Gildersleeves Logging Incorporated Floating Camp

Up to 15 families live at the Gildersleeves Logging Inc. floating logging camp, located in Dora Bay, during the logging and construction season, and up to 50 people reside in the bunkhouse at the camp. Most residents reside in the camp just during the busy season, though some families do reside there year-round. Those year-round permanent residents are likely qualified subsistence users, while the others may or may not be qualified subsistence users. Whether or not they are qualified depends on where their permanent residence is located. It is likely that most residents of the camp do harvest fish and wildlife resources in the Cholmondeley Sound area.

Kootznoowoo Native Corporation Camp

Kootznoowoo Native Corporation maintains a permanent shore based camp in Dora Bay and operates their deep water port facility from this shore based camp. The camp caretaker is the only permanent resident. The other camp residents are longshoremen that are flown in when there is a ship to be loaded or unloaded. While loading or unloading ships, the longshoremen reside in a bunkhouse at the camp. When the job is finished they are flown back to their home community.

Divide Head Development

Kootznoowoo Native Corporation is developing their land at Divide Head. They have subdivided it and are currently selling lots. To date five residences have been built and more building is anticipated in the near future. It is not known whether any of the completed homes or cabins are occupied permanently. If they are occupied permanently, those residents would become or are qualified subsistence users.

Sunny Cove

Eight families are jointly operating an oyster farm in Sunny Cove. The operation is based from the privately owned land in the cove. It is not known whether all eight families reside at Sunny Cove. Those that designate Sunny Cove as their permanent residence are qualified subsistence users.

810 Evaluation - Effects of The Alternatives

Introduction

Section 810 of ANILCA (Public Law 96487) requires a Federal agency having jurisdiction over lands in Alaska to evaluate the potential effects of proposed land use activities on subsistence uses and needs. Section 810(a) of ANILCA states:

> *In determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands under any provision of law authorizing such actions, the head of the Federal agency having primary jurisdiction over such lands or his designee shall evaluate the effects of such use, occupancy, or disposition on subsistence uses and needs, the availability of other lands for the purposes sought to be achieved, and other alternatives which would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes. No such withdrawal, reservation, lease, permit, or other use, occupancy or disposition of such lands which would significantly restrict subsistence uses shall be effected until the head of such Federal agency:*
>
> *(1) gives notice to the appropriate State agency and the appropriate local committees and regional councils established pursuant to [ANILCA] Section 805;*
>
> *(2) gives notice of, and holds, a hearing in the vicinity of the area involved; and;*
>
> *(3) determines that (A) such a significant restriction of subsistence uses is necessary, consistent with sound management principles for the utilization of the public lands; (B) the proposed activity will involve the minimal amount of public lands necessary to accomplish the purposes of such use, occupancy, or other disposition; and © reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such action.*

This section evaluates how the proposed action alternatives could affect subsistence resources used by the rural communities potentially using the project area and the non-rural community of Ketchikan. The subsistence resource categories evaluated are deer, black bear, furbearers, waterfowl, marine mammals, salmon, other finfish, shellfish, other food resources, and firewood.

Evaluation Criteria

Criteria used to evaluate the effects of the proposed alternatives are: (1) changes in abundance or distribution of subsistence resources, (2) changes in access to subsistence resources, and (3) changes in competition from non-subsistence users for those resources. The evaluation determines whether subsistence opportunities in the project area or portions of the project area may be significantly restricted by any of the proposed action alternatives. To determine this, the evaluation: (1) considers the availability of subsistence resources in the surrounding areas; (2) considers the cumulative impacts of past, present, and foreseeable future activities on subsistence users and resources; (3) looks at potential cultural and socioeconomic implications affecting subsistence users; and (4) focuses on the mapped subsistence use area in the project area.

This subsistence evaluation considers, with distinct findings by alternative and by resource category, whether or not there is a significant possibility of a significant restriction of subsistence use. The Alaska Land Use Council definition of "significant restriction of subsistence use" is one guideline used in the findings. By this definition:

A proposed action shall be considered to significantly restrict subsistence uses, if after any modification warranted by consideration of alternatives, conditions, or stipulations, it can be expected to result in a substantial reduction in the opportunity to continue subsistence uses of renewable resources. Reductions in the opportunity to continue subsistence uses generally are caused by: reductions in abundance of, or major redistribution of resources; substantial interference with access; or major increases in the use of those resources by non-rural residents. The responsible line officer must be sensitive to localized, individual restrictions created by any action and make his/her decision after a reasonable analysis of the information available.

The U.S. District Court Decision of Record in Kunaknana v. Watt provided additional definitions of "significant restriction of subsistence uses" and are also used as guidelines in the findings. The definitions from Kunaknana v. Watt include:

Significant restrictions are differentiated from insignificant restrictions by a process assessing whether the action undertaken shall have no or slight effect as opposed to large or substantial effects. In further explanation the Director (BLM) states that no significant restriction results when there would be "no or slight" reduction in the abundance of harvestable resources and no occasional redistribution of these resources. There would be no effect (slight inconvenience) on the ability of harvesters to reach and use active subsistence harvesting site; and there would be no substantial increase in competition for harvestable resources (that is, no substantial increase in hunting by non-rural residents).

Conversely, restrictions for subsistence uses would be significant if there were large reductions in abundance or major redistribution of these resources, substantial interference with harvestable access to active subsistence-use sites or major increases in non-rural resident hunting. In light of this definition, the finding of significant restriction must be made on a reasonable basis, because it must be decided in light of the total subsistence lands and resources that are available to individuals in surrounding areas living a subsistence lifestyle. The Draft EIS evaluates the availability of subsistence resources in surrounding areas that could be accessed without undue risk or economic hardship to subsistence users.

Direct, Indirect, and Cumulative Impacts on Subsistence Use of Deer

The areas of greatest documented deer harvest has been in WAA 1211. Access is primarily if not totally by water. Some hunters use ATVs (transported by boat) on these road networks, while others hunt the shore from boats or walk.

Abundance and Distribution

Determining what harvest levels are sustainable assumes that habitat capability projections from the deer harvest model reflect an approximation of deer population over the long term (short-term deviations from the modeled results are not unusual). It also assumes that the distribution of deer harvest across a WAA is approximately proportional to the available

habitat. Furthermore, it is based on the determination that the sustainable harvest is 10 percent of the deer population (Flynn and Suring 1989). The analysis assumes that the 1987 to 1994 deer harvest reflects rural and non-rural community use of deer in project area WAAs. ADF&G has collected deer harvest data for individual WAAs since 1987.

Averaging the deer harvest makes allowance for factors that influence deer numbers and hunting activity from year to year, such as weather patterns, access, habitat capability, and hunting success.

Non-rural residents harvested an average of 64 deer or 80 percent of the deer taken from the project area WAAs, while rural residents harvested an average of 16 deer or 20 percent during 1987 to 1994 (Table SUB-2). Based on the assumptions described above, Table SUB-12 presents the estimated project area deer population needed to support these harvests and compares them to present and future habitat capabilities drawn from the TLMP RSDEIS (1996a). Fragmentation effects were assumed to be the same as the patch-size effectiveness percents developed for the project area alternatives. This table indicates that the documented average deer harvest can be expected to be sustainable beyond 2040, even if all timber harvest anticipated in TLMP takes place.

In order to account for increases in demand over time, observed harvest levels are increased for harvest projections based on Alaska State population projections. An average increase of 1.8 percent per year is used through 2010 and 1.5 percent per year thereafter. Table SUB-12 incorporated a correction factor by supplying an estimate of future increased demand for deer because of increased population or other factors. When compared with the habitat capabilities for future dates in Table SUB-12, it is still clear that if the proposed action takes place, the estimated habitat capabilities in each WAA would still be well above that required to support the average documented harvest of deer. Habitat capability for all WAAs should be able to sustain the harvest by rural and non-rural communities.

Table SUB-12
Deer Populations Needed to Support Projected Demand from Rural and Non-rural Communities Compared to Habitat Capability in WAAs 1210, 1211, and 1213 Combined

	1954	1995	2000*** (Alt. 6 Max Harvest)	2010	2040
Habitat Capability * (Without Patch-Size Effects)	6,012	5,984	5,680	5,618	4,414
Habitat Capability (With Patch-Size Effects)	5,291	5,003	4,300	4,253	3,341
Deer Population Needed** to Meet Projected Demand	800	800	870	1,020	1,480

SOURCE: Deer harvest statistics are from ADF&G hunter survey data files. Habitat capability figures are from the TLMP Draft Revision (1991a). These figures are for the entire WAA.

* Habitat capabilities are for entire WAAs are from the TLMP Draft Revision, Appendix L (1991a) minus project effects.
** Assumes that 10 percent of the deer population can be harvested on a sustained yield basis (ADF&G).
*** Alternative 6 was chosen for comparison because it is the maximum harvest alternative.

Note: Population objectives for WAAs 1210, 1211, and 1213 is 4,509 without patch-size effects taken into consideration.

The cumulative effects of the proposed action will still meet ADF&G deer population objectives for all of the project area WAAs. However, at some point beyond the foreseeable future (approximately 2040), timber harvest might reduce the habitat capability below ADF&G population objective.

Access and Competition

Effects resulting from changes in access to the project area may be the most significant potential effects of the proposed action, and so may be the major differentiation between alternatives in terms of potential effects upon subsistence resources and patterns of use. Access to traditional subsistence use areas may be affected where logging activities take place near the beach fringe because traditional subsistence access includes use by boat on the beaches of the project area. However, this effect on access would probably be minor under all alternatives because little beach fringe would be harvested in the project area. It would likely make those hunters and trappers who currently use the area somewhat more efficient, rather than attracting many "new" users to the area. Roads, whether temporary or permanent, have the greatest potential to increase access.

For the purposes of discussing access effects, most of the alternatives would be very similar. The major distinction would be between those without proposed roads. Those alternatives without roads may increase access somewhat, but not to any significant degree.

The biggest change would be an increase in access to the project area if roads constructed on Hydaburg Native Corporation lands in the Big Creek and Sulzer Portage area are connected to Hydaburg.

Findings for Deer

Table SUB-12 indicates that even after all likely future timber harvest within the project area occurs, habitat capability for deer would be adequate to support the projected demand for deer. Timber harvest beyond that envisioned by the TLMP RSDEIS (1996a) could produce significant effects.

Table SUB-13
Significant Possibility of a Significant Restriction of Subsistence Use of Deer for each Alternative

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Abundance/Distribution All Communities	No	No	No	No	No	No
Access All communities	No	No	No	No	No	No
Competition All Communities	No	No	No	No	No	No

Note: "No" indicates an insignificant possibility of a substantial effect.
"Yes" indicates a significant possibility of a substantial effect.

The most obvious mitigation measures for such effects would be road/access management to retard the potential increase in the demand for deer associated with new road access and/or the restriction of non-subsistence hunting. Again, this is because the major potential effect of the proposed action arises from increased access, and most of the documented harvest activity in the project area is from Ketchikan.

Summary of Findings for Deer

None of the action alternatives will create a significant possibility of a significant restriction of subsistence use of Sitka black-tailed deer. Based on reported use of the project area, there should be adequate habitat to support projected demand into the future, so there should not be a restriction of subsistence use of deer because of abundance/distribution. Access to the project area will not significantly change from current conditions as a result of the proposed project.

Direct, Indirect, and Cumulative Subsistence Use of Other Resources

Other resources have a lower rate of documented use, and are less limiting in terms of use of the project area, with the possible exception of fish. Black bear, marten, river otter, and wolf are the primary species that are evaluated.

Black Bear

Black bear generally are not used as a major food source and most documented harvest has been by non-subsistence hunters. Of the 98 bears noted on Table SUB-6 in the years 1988 through 1993, black bears were taken by non-resident sport hunters and most of the rest by Ketchikan hunters. Some subsistence hunting of bear occurs, but subsistence interviews suggest that it is relatively infrequent. Only one bear was harvested by an individual from a rural community—Metlakatla.

Table SUB-14

Project Area Black Bear Populations Needed to Support Documented Demand from Rural and Non-rural Communities Compared to Habitat Capability in WAAs 1210, 1211, and 1213 Combined

Avg. Yearly Harvest	Population Needed to Support Harvest	1954 Habitat Capability	Current Habitat Capability	Post Project Habitat Capability*	2040 Habitat Capability**
16	160	278	276	266	220

SOURCE: Bear harvest statistics are from ADF&G data files.

* Alternative 6 was used for comparison, as it was the maximum harvest alternative.
** Assumes 10 percent of the bear population can be harvested on a sustained yield basis (ADF&G).

Table SUB-14 displays the bear habitat capability required to support the annual documented black bear harvest. There appear to be no habitat degradation problems and habitat capability would not be a limiting factor for any of the alternatives, based on HCM information from the preferred alternative of the proposed TLMP RSDEIS (1996a). Further, documented subsistence use is so low that there would be little adverse competitive effect of increased access if this were taken at face value. However, it is likely that the subsistence harvest of bear is higher than documented, and it is also likely that increased access could increase subsistence demand for bear from the project area.

All action alternatives with road construction could potentially increase both subsistence and non-subsistence demand for bear from the area. As noted above, increased access could attract increased effort from local subsistence and non-subsistence hunters.

These conclusions agree with the general conclusions of a healthy local population in the ADF&G's series of annual performance reports of survey-inventory activities for black bear (Abbott, various dates).

Furbearers

Furbearers are currently being trapped in the project area. Tables SUB-15 and SUB-16 display the populations of marten and river otter required to support the average documented harvest of each by project area WAA, and projected habitat capability values for those WAAs. No attempt is made to estimate increased demand, because there is no clear relationship between furbearer harvest and human population (animal population and price appear to be much more important factors).

Marten

Of the 544 marten reported as harvested from 1987 to 1993, 370 were taken by Ketchikan residents (Table SUB-7). Table SUB-7 indicates that the habitat capability for WAAs 1211 and 1213 would not support the current level of harvest even at 1954 habitat capability. The proposed action would not contribute significantly to this effect, which is primarily due to prior harvest, animal populations peaking above habitat capability model "limits" (when trappers would most logically target that area), or both. Due to the number of marten trapped by Ketchikan residents, there is a significant possibility of a significant restriction in subsistence use of marten as a result of competition for all alternatives, including the no-action alternative.

Table SUB-15

Project Area Marten Populations Needed to Support Documented Year Demand from Rural and Non-rural Communities Compared to Habitat Capability

WAA	Avg. Rural Harvest	Avg. Non-rural Harvest	1954 Habitat Capability	1995 Habitat Capability Pre-Project	Habitat Capability Post-Project Alt. 6*	Avg. Total Harvest	Population Needed to Support**
1210	6	24	150	150	148	30	75
1211	13	34	90	89	79	47	118
1213	0	34	58	57	56	34	85
Total	**19**	**92**	**298**	**296**	**283**	**111**	**278**

SOURCE: Marten harvest statistics are from ADF&C data files.

* Alternative 6 was chosen for comparison because it represents the maximum harvest.
** Assumes 40 percent of the marten population can be harvested on a sustained yield basis (ADF&G).
Note: Habitat capability numbers do not take into account road density effects.

River Otter

Of the 44 river otter reported as harvested from 1988 to 1994, from project area WAAs, there were similar harvest levels by Ketchikan, Klawock, and Thorne Bay residents.

The project area WAAs currently contain sufficient habitat capability to sustain the current level of documented harvest on an annual basis (Table SUB-16), even after the project is implemented. As has been noted before, the actual pattern of trapping is for most of the take to occur in a few years of very high success, interspersed with longer periods of very low take. This corresponds to the cyclical nature of furbearer populations, as well as fluctuations in fur prices. While there does not appear to be a possibility of a significant restriction on subsistence use of river otter, there could be in the future as a result of better access created by the Hydaburg/Sulzer Portage road being constructed.

Table SUB-16

Project Area River Otter Populations Needed to Support Documented Demand from Rural and Non-rural Communities Compared to Habitat Capability

WAA	Avg. Rural Harvest	Avg. Non-rural Harvest	Total Average Harvest	1954 Habitat Capability	1998 Habitat Capability	Capability Post-Project Alt. 6*	Population Needed to Support**
1210	<1	0	<1	83	83	83	5
1211	5	1	6	53	52	51	30
1213	<1	0	<1	32	31	31	5
Totals	**5**	**1**	**6**	**108**	**166**	**165**	**40**

SOURCE: River otter harvest statistics are from ADF&G data files.

* Based on Alternative 6—the maximum harvest alternative.

** Assumes 20 percent of the river otter population can be harvested on a sustained yield basis (ADF&G).

Wolf

Wolf harvest within the project area WAAs appears to be sustainable overall, but exceeds habitat capability in WAA 1213. This is about the same situation as the marten harvest—adequate habitat capability to meet subsistence demand, but because of competition from Ketchikan residents, there may be a significant possibility of a significant restriction in subsistence use of wolves.

Table SUB-17

Project Area Wolf Populations Needed to Support Documented Demand from Rural and Non-rural Communities Compared to Habitat Capability

WAA	Avg. Rural Harvest	Avg. Non-rural Harvest	Total Average Harvest	1954 Habitat Capability	1998 Habitat Capability	Capability Post-Project Alt. 6*	Population Needed to Support**
1210	<1	<1	1	10	10	10	4
1211	1	1	2	8	8	7	8
1213	0	2	2	5	5	5	8
Total	**2**	**3**	**5**	**23**	**23**	**22**	**20**

SOURCE: Wolf harvest statistics are from ADF&G data files.

* Based on Alternative 6—the maximum harvest alternative.

** Assumes 25 percent of the wolf population can be harvested on a sustained yield basis.

Waterfowl

Waterfowl are harvested in the project area, and are an important supplementary subsistence resource. There are no indications that the waterfowl harvest would be affected by the proposed action, since habitat capabilities should not be affected and road construction would not increase access to areas used for waterfowl harvest.

Marine Mammals

Federal law prohibits the taking of marine mammals by anyone other than Native hunters. Timber harvest activities are not expected to have any effect on marine mammals taken for subsistence or on marine mammal habitat.

Salmon

Salmon are a major subsistence food harvested in the project area. The Aquatic Resources section concludes that potential effects of the proposed timber harvest and road construction alternatives on salmon spawning and rearing habitat would be minimal or eliminated by applying the Forest Service standards, guidelines, and prescriptions described in detail in the Aquatic Habitat Management Handbook (FSH 2509.22) and Soil and Water Conservation Handbook (FSH 2609.24).

Other Finfish

The action alternatives for the proposed project would have no immediate or foreseeable effect on other finfish habitat. Because there would be no effect on other finfish habitat, the abundance and distribution of those other finfish would not be affected. Access and competitive effects are also unlikely, although access to some areas may be increased somewhat by the proposed action.

Shellfish

Anticipated effects on the abundance and distribution of local crabs, clams, and other shellfish would not be measurable for purposes of subsistence. Access and competition should also not be affected, although there may be some periodic conflicts between log rafts being stored or towed, and the crabbing or shrimping of some bays and inlets.

Other Food Resources

Other foods include plants such as kelp, goose tongue, and a variety of berries. Most traditional gathering of these foods occurs near beach and estuarine areas. Timber harvest will be minimal for these areas. Some increased access to interior gathering sites may be increased under all alternatives. Road construction activities would improve access to berry picking sites that are now not reasonably accessible.

Because beach fringe and estuaries would not be significantly affected by the proposed project, and because additional food gathering sites would be made available, the project's activities and foreseeable impacts are not expected to substantially affect the abundance and distribution of other foods.

Firewood/Personal Use Wood

The Forest Service has a free-use policy (with limits) for firewood and timber and none of the proposed alternatives would have an adverse effect on the availability of firewood, personal-use timber, and traditional uses of wood, such as for totem poles.

Summary Findings for Other Resources

Subsistence findings for resources for which there is some possibility of a significant restriction related to the project are summarized in Table SUB-19. Subsistence findings for resources for which there is not a significant possibility of a significant restriction are summarized in Tables SUB-18, 20, and 21. Positive findings relate to marten and wolf.

None of the project alternatives will have a significant possibility of having a significant restriction on subsistence resources in relation to the abundance or distribution of subsistence resources (although as noted in the analysis, habitat capability for marten and wolf is already in the pre-existing condition, below that required to support the average documented level of harvest). That is, habitat degradation effects associated with this project would be minimal. Cumulative effects in this regard would also be minimal, with a positive finding only for marten and wolf, due primarily to the effects of current trapping pressure by non-rural residents primarily from Ketchikan.

Those project alternatives that propose road construction do have a significant possibility of producing a significant restriction on subsistence uses due to competitive effects directly related to the cumulative effects of this and other nearby projects for marten and wolf. These effects would also be more long term than immediate, since they are related to increased

access and the future (and presently unknowable) behavior of non-rural trappers. These effects could also potentially be mitigated by access (road) management measures and/or the restriction of non-rural hunters by the Federal Subsistence Board.

None of the project alternatives would have a significant possibility of having a significant restriction on subsistence resources in relation to access to these resources. Cumulative effects findings are also negative in this regard.

Table SUB-18
Significant Possibility of a Significant Restriction of Subsistence Use of Black Bear for Each Alternative and Community

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Abundance/Distribution All Communities	No	No	No	No	No	No
Access All Communities	No	No	No	No	No	No
All Other Communities	No	No	No	No	No	No

Note: "No" indicates an insignificant possibility of a substantial effect.
"Yes" indicates a significant possibility of a substantial effect.

Table SUB-19
Significant Possibility of a Significant Restriction of Subsistence Use of Marten, River Otter, and Wolf for Each Alternative and Community

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Abundance/Distribution All Communities*	Yes	Yes	Yes	Yes	Yes	Yes
Access All Communities	No	No	No	No	No	No
Competition All Communities**	Yes	Yes	Yes	Yes	Yes	Yes

* Habitat Capability is below that required to sustain the average documented level of harvest of marten and wolf even for the no-action alternative.
** Could be increased competition in the future based on improved access to the area as a result of the Hydaburg/Sulzer Portage road being constructed on Hydaburg Native Corporation lands.

Note: "No" indicates an insignificant possibility of a substantial effect.
"Yes" indicates a significant possibility of a substantial effect.

Table SUB-20
Significant Possibility of a Significant Restriction of Subsistence Use of Salmon for Each Alternative and Community

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Abundance/Distribution All Communities	No	No	No	No	No	No
Access All Communities	No	No	No	No	No	No
Competition All Communities	No	No	No	No	No	No

Note: "No" indicates an insignificant possibility of a substantial effect.
"Yes" indicates a significant possibility of a substantial effect.

Table SUB-21
Significant Possibility of a Significant Restriction of Subsistence Use of Other Resources for Each Alternative and Community

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Abundance/Distribution All Communities	No	No	No	No	No	No
Access All Communities	No	No	No	No	No	No
Competition All Communities	No	No	No	No	No	No

Note: "No" indicates an insignificant possibility of a substantial effect.
"Yes" indicates a significant possibility of a substantial effect.

EIS Conclusions

Section 810(a)(3) of ANILCA (P.L. 96-487, 1980) requires that when a significant restriction may occur, determinations must be made in regard to whether:

- such a significant restriction of subsistence uses is necessary, consistent with sound management principles for the utilization of public lands;
- the proposed activity will involve the minimum amount of public lands necessary to accomplish the purposes of such use, occupancy, or other disposition; and;

- reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such actions.

The following section outlines the other subsistence conclusions.

Necessary and Consistent with Sound Management of Public Lands

The alternatives have been examined to determine whether they are necessary and consistent with sound management of public lands. In this regard, the National Forest Management Act of 1976, ANILCA, the Alaska Regional Guide, the TLMP, the TLMP 1985-86 Amendments, the 1996 TLMP RSDEIS, the Alaska State Forest Practices Act, and the Alaska Coastal Zone Management Program have been considered.

The ANILCA emphasized the maintenance of subsistence resources and lifestyles. However, the Act also required the Forest Service to manage the forest for multiple use. The alternatives presented here encompass four different approaches that would produce the resources that would best meet the purpose and need of this project. All of the action alternatives involve some potential to affect subsistence uses. There is no alternative that would avoid a significant possibility of subsistence restrictions somewhere in the National Forest. Therefore, based on the analysis of the proposed alternatives presented in this document, these actions are necessary, consistent with the sound management of public lands.

Amount of Public Land Necessary to Accomplish the Purpose of the Proposed Action

Much of the Tongass National Forest is used for deer hunting by one or more rural communities for subsistence purposes. The areas of most subsistence use are the areas adjacent to beaches or other water access, and areas in proximity to communities. Within the project area, the extent and location of the subsistence use areas precludes complete avoidance. Areas other than subsistence use areas that could be used for the project may be limited by other resource concerns such as soil and water protection, high value wildlife habitat, economics, visual resources, or road design. Effort was taken to protect the highest value subsistence areas. The greatest subsistence effect would be from road construction and the resulting increased access to and competition for subsistence resources.

Reasonable Steps to Minimize Adverse Impacts Upon Subsistence Uses and Resources

Reasonable steps to minimize impacts on subsistence have been incorporated in development of the alternatives and project design criteria. Project design criteria called for locating units and roads outside of important subsistence use areas such as beach fringe, estuary fringe, and riparian areas adjacent to salmon streams, to the extent possible.

DEIS Conclusions

The Record of Decision (ROD) for the Chasina Project will include a final determination about the significant restriction on subsistence use that may result from implementation of the Selected Alternative. In summary, the potential foreseeable effects from the action alternatives in the project area do not present a significant possibility of a significant restriction of subsistence uses of deer, black bear, river otter, marine mammals, waterfowl, other finfish, shellfish, and other foods. However, a significant possibility of a significant restriction does exist for marten and wolf for all alternatives including the no-action alternative because of existing competition from non-rural trappers.

Hearings

On the basis of findings of this analysis and under the provisions of ANILCA, subsistence hearings will be conducted in Saxman and Hydaburg. Letters will be sent to the Federal Subsistence Board, Alaska Department of Fish and Game, Regional Fish and Game Advisory Councils, Local Fish and Game Advisory Committees, and to the Post Offices in Saxman and Hydaburg. Announcements will be made in newspapers and on the radio. Additional mailings and public notices will be made to communities outside of the immediate project area who use subsistence resources. These notifications will be made based upon scoping comments received, TRUCS use data, and public and agency suggestions.

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Cultural Resources

Key Terms

Cultural Resources—all evidence of past human-related activity. This evidence may be historic or prehistoric, architectural or archived in nature. Cultural resources are non-renewable aspects of our national heritage.
Sensitivity Zone—defined as "high" or "low" based on the probability that they might contain intact, observable cultural resources.
SHPO—Alaska State Historic Preservation Officer

Affected Environment

Introduction

Human occupation of the Pacific Northwest Coast spans more than 10,000 years. Information about the earliest people is sparse. It is contained in the oral histories of the Native people of Southeast Alaska, many of which were recorded by ethnographers of the nineteenth and early twentieth centuries (Emmons 1991; Swanton 1905, 1966, 1975). Archeological sites, natural areas that contain the material cultures of the daily lives of historic or prehistoric people, also provide information. Details of the traditional lives of the early people are becoming clearer with more archaeological sites being discovered, and more reliable analogies of Native societies from the 1700s to the present. For the historic period, post-dating the 1770s for Prince of Wales Island, we have the observations of explorers, the accounts of Native people, the journals of a variety of individuals, and government and business records. And, although few archaeological sites in Southeast Alaska have been systematically investigated to date, the pace of study is increasing and the understanding of regional prehistory is increasing as well.

Prehistory

Both Tlingit and Haida oral traditions suggest inland origins and migration to the coast down the Skeena (Tlingit and Haida) and Taku (Tlingit) Rivers at an unspecified time in the past. In both cases the traditions say the groups displaced earlier residents as they moved into their historic territories, the Tlingit expanding northward and the Haida moving to the Queen Charlottes.

The question of when the human prehistory of Southeast Alaska begins is one that fascinates many scientists. Recent discoveries of fossil bear skeletons on Prince of Wales Island and Dall Island suggest that portions of the coast were free of ice 12,000 years ago or earlier. A good deal of speculation, driven by the spatial and temporal distribution of archaeological sites elsewhere in the western hemisphere, revolves around the theory that people may have occupied the now submerged continental shelf during periods of lower relative sea level, perhaps as early as 17,000 years ago. However, this theory remains unproven. The earliest solid evidence of human presence in Southeast Alaska dates to approximately 10,000 years before present (BP). Drawing on the few systematic excavations to date, several archaeologists have constructed cultural chronologies for the region (Davis 1990, Moss n.d., Fladmark 1982). The following discussion is derived from Davis' chronology and focuses on tool technology.

The Paleomarine Tradition (10,000 to 6,500 years BP) is the earliest recognized cultural tradition (Table CUL-1). Sites or components of sites assigned to this tradition contain micro blades, wedge-shaped micro blade cores, and few if any bifacially flaked stone tools. Animal remains at these sites include fish bone and marine shell, indicating a coastal, marine subsistence lifestyle (Davis 1990). The Thorne River site is the only site on Prince of Wales Island assigned to the Paleomarine Tradition (Holmes 1989). Two additional Paleomarine sites are located on Heceta Island, off the west coat of Prince of Wales Island (Ackerman et al. 1985).

As the name implies, the Transitional Stage (6,500 to 5,000 years BP) represents a transition between the technology of the Paleomarine Tradition and that of the later Developmental Northwest Coast Tradition. Faunal and floral remains and the inland location of some sites suggest adaptation to a changing environment (Davis 1990).

The Developmental Northwest Coast Tradition (5,000 years BP to contact) contains multiple phases and is distinguished from the Transitional Stage by the presence of shell midden deposits, ground stone and bone technology, human burials, larger settlements (winter villages), specialized subsistence camps, fortifications, and native metal (Davis 1990). The Coffman Cove and Sarkar Cove sites and Yatuk Creek Rockshelter, all north of the project area in the central portion of Prince of Wales Island, and Rosie's Rockshelter on Heceta Island, contain components representing this tradition (Ackerman et al. 1985; Ardnt et al. 1987; Clark 1979a and 1979b, Campbell 1984b). The beginning of this tradition possibly corresponds to the entry of the contemporary Native population, known as the Tlingit, into the area.

Table CUL-1
Cultural Chronology

Tradition	Date	Cultural Material	Selected Sites
American Historic	A.D. 1867	Modern tools, structures, and social systems. Gold discovered in SE Alaska in 1869.	Numerous
Russian Historic	A.D. 1798	Historic fur trade goods; metal tools, glass, ceramics, beads. Trade as early as 1759.	Numerous
Developmental NW Coast Late Phase	1000-1750 B.P.	Native copper, stone vessels, increased use of obsidian, rise of fortified sites and villages.	Starrigavan, Russian Cove, Old Town, Yatuk Creek Rockshelter
Developmental NW Coast Middle phase	3000-1000 B.P.	Unilaterally barbed points, nephrite, ground burins, toggling harpoons, small end blades.	Hidden Falls, Sarkar Entrance, Young Bay, Yatuk Creek Rockshelter, Portage Arm
Developmental NW Coast Early Phase	5000-4000 B.P.	Ground stone, bone, woodworking tools.	Hidden Falls, Rosie's Rockshelter, Coffman Cove, Traders Island
Transitional State	6500-5000 B.P.	Ground stone, bifacial flaked stone	Lake Eva, Chuck Lake, Irish Creek
Paleomarine	10,000-6500 B.P.	Unifacial flaked stone, cores, blades, fish bones, marine shell.	Hidden Falls, Chuck Lake, Thorne River, Ground Hog Bay

SOURCE: Davis 1990.

Although the exact dates of occupation are not known, the Tlingit were well established in Southeast Alaska by the time of first Russian contact. The settlement and subsistence patterns of the Tlingit demonstrate a long-term adaptation to their environment. The Haida, who occupied the northern part of the Chasina Project Area at the time of European contact, are relative newcomers to the area. They moved north from the Queen Charlottes in the early seventeenth century displacing the Taant'akwaan of the southern Tlingit on the southern third of Prince of Wales Island.

Ethnohistory

Prince of Wales Island was formerly divided among several subgroups of Tlingits: the Stikine (Shtax'heen Kwaan) included the northeast coast in their territory; the Henya (Heinyaa Kwaan) inhabited the northern half of the western part of the island; the Klawock (Lawaak Kwaan), who may also have been part of the Henya, resided along the west-central coast; and the Tongass (Taant'akwaan) held the southern third of the island before the Kaigani Haida displaced them, in the early eighteenth century, to a small section along the coastline of southern Southeast Alaska and the islands to the east (Ardnt et al. 1987). Though no villages are known within the Chasina Project Area, both the Kaigani Haida and the Taant'akwaan used the area at the time of first European contact. The Taant'akwaan claimed Johnson Cove and Moira Sound while the Kaigani Haida claimed the area to the north as far as the Kasaan Peninsula.

History

The Historic Period (Stone and Stone 1980) began with the explorations of Europeans to discover new lands and seek valuable furs. The discoveries of gold at Windham Bay in 1869 and later finds of large deposits of gold ore in Juneau by 1880 brought dramatic change to the previous maritime way of life of the Tlingit and Haida. Use of non-renewable extractive resources over the last century considerably affected aboriginal lifestyles, especially in the northern panhandle where large gold mining operations operated. An Alaska Territory tax levied in 1937 on the gross production of precious metals discouraged further investment in state mining. This hiatus extended through World War II. There have been more recent attempts to start large scale mining with the advent of cyanide leach techniques, such as the A-J and Kennsington ventures.

Timber harvesting and fishing, renewable extractive resource activities, have also dramatically changed the life ways of aboriginal peoples. However, these ventures that began in the 1880s have become ongoing and integral parts of the lives of 20th century Natives in Southeast Alaska.

Historic Land Use in the Chasina Project Area

South Arm of Cholmondeley Sound

There were a number of mines established in the Cholmondeley area during the first decade of the 20th century. Mines on the west side of South Arm which fall within the project area are Friendship, Ruby Tuesday (originally the Ketchikan Copper Company prospect), Moonshine, and Hope-Cholmondeley. These mines were excavated and ore was produced during the early 1900s. Lead, zinc, copper, and silver are found in deposits associated with these mines (Maas et al. 1995).

The Ruby Tuesday Prospect was called the Ketchikan Copper Company prospect before the 1900s. By 1901 a 91 meter adit had been excavated. In 1947 the name was changed to Polymetal Lode and then changed again in 1978-1979 to Ruby Tuesday. In 1988, LAC Minerals USA, Inc. and Noranda Inc. owned the mine, adding the Kennecott Copper Company as a partner in 1993. Zinc, lead, and copper were being mined from the Ruby Tuesday deposits.

Claims to the Moonshine mine were staked in 1905 and 1906 at 55° 11' North, 132° 23' West. A 27 meter shaft and a 61 meter hand-drilled adit were among the first excavations at the site (Roppel 1991, Maas et al. 1995). Millnor Roberts, a former professor at the University of Washington, became the engineer for the mine in 1907 and established a camp on the beach in South Arm and constructed a road to the mine. The construction of the road employed 37

men, including a blacksmith with a forge. Facilities at the mine included crew quarters which burned down in September 1907, skids, and a dumping area (Roppel 1991). "Miners drilled by hand, and a hand windlass and bucket raised the ore and waste from the shaft. The only convenience in the drift resulted from installation of rails and a Truax ore car" (Roppel 1991:103).

In 1921, a 1.5 mile gas operated, single-wire, aerial tram was run from the Moonshine camp to the beach (Roppel 1991, Maas et al. 1995). The frames from a tram-car and a cable extending up-hill from the beach were recorded at CRG-449 in 1995. A cave-in created a glory hole 135 x 50 feet at Moonshine mine which eventually led to the mine's closure in 1924. An engineer visiting in 1942 stated that the road from the beach was grown over and the bridges were rotten (Roppel 1991). Claims were restaked in 1948, although the tunnel and the shaft were in very poor condition. Photographs of the operation at Moonshine mine in 1907 are available at the University of Washington archives.

The Hope-Cholmondeley Prospect is 0.6 kilometers southeast of the Moonshine mine (Maas et al. 1995). Zinc, lead, and silver have been found in deposits at the mine. Work at this mine took place in the early 1900s when a six meter shaft, eight meter adit, and 10 meter trench and open cuts were excavated. Maas et al. (1995:107) reported that the last assessment work took place in 1915. The Hope-Cholmondeley prospect lies just within the Chasina Project Area.

The largest cannery within the project area was at Cholmondeley, west of South Arm. It began as a saltery in the 1890s, was rebuilt in 1904, and then sold in 1909. C.A. Burkhardt and Company with Alaska Pacific Fisheries built a cannery over the saltery and began production in 1911 (Roppel pers. comm). The Cholmondeley cannery closed in 1930 and was not re-opened (Orth 1971). The U.S. Coast Pilot (1988) reported that there was a post office, general store, radio station, and wharf as well as an oil wharf and float. Today, the bay is privately owned and three cabins and associated out-buildings are built over the site of the cannery. Lines of pilings, a barge, and a large concrete structure lie within the intertidal zone.

South Arm was also an important fishing location. People from Kasaan would use South Arm when fishing commercially for dog or chum salmon (Goldschmidt and Haas 1946). There was also a village at the head of South Arm where fish were usually dried and smoked during the summer and fall.

Kitkun Bay

Croesus and San Juan mines are at the southeast end of Kitkun Bay. Croesus is a silver mine which consists of three adits, measuring 98 meters, 6 meters, and 40 meters, as well as a caved in shaft. San Juan, another silver mine, includes a 59 meter adit, a shaft, and a caved in trench (Maas et al. 1995).

Kitkun Bay was also used for commercial fishing and trapping (Goldschmidt and Haas 1946). A man named Kitkun lived in this area and had a trapping cabin at the mouth of the bay near the rapids. He is also said to be responsible for finding deposits on the shore of Kitkun Bay, which led to the establishment of many of the mines discussed earlier.

Lancaster Cove

Kael Pit, Gladstone, Equator, Saco and CRG-451 are all in the Lancaster Cove Area. Kael-7 Mile Trend consists of several pits and trenches and produces silver, gold, and copper. This mine was discovered in 1988 by a geologist working for Sealaska and was leased in 1990 to

American Copper and Nickle Company (Maas et al. 1995). Gladstone also produced silver and copper and consists of an 11 meter adit. Saco and the neighboring Equator adits (12 meters and 19 meters respectively) were primarily copper producing mines. CRG-451 was a turn of the century mine with a 17.5 meter L shaped adit. It is southeast of the Equator and Saco mines which have similar length adits.

Clarence Strait

The only mine recorded on the eastern shore of the project area is the Windy Cove prospect west of Windy Point. There is a nine meter adit, pits, and cuts producing silver and copper (Maas et al. 1995). This mine is on or near Sealaska land. Because it is on or near Sealaska land and not directly affected by any harvest units, it was not visited by U.S. Forest Service archaeologists.

In the vicinity of Chasina Point there is reported to be a Haida village (Goldschmidt and Haas 1946; Orth 1971). Russian charts record a settlement at this location in the mid-1850's (Orth 1971). This village was apparently established during the movement of the Haida northward just before Old Kasaan was settled (Roppel pers. comm.). At the turn of the century it was used by Kitkun and his family (Goldschmidt and Haas 1946). His family had a garden, dried and smoked fish, and collected seaweed here. Later the area was used for commercial fishing and trapping.

The whole coast from Chasina Point to Port Johnson was used for commercial fishing and occasional camps were set up in protected bays (Goldschmidt and Haas 1946). This area is still a popular location for commercial fishing, creating labyrinths of nets along the coastline in the summer and fall.

Port Johnson and Paul Lake Area

This is the most active mining location within the project area, and was the focus of much of the mining history on Prince of Wales Island. In 1899, gold was found at the Valparaiso and Golden Fleece Mines. These are both owned by Sealaska now, as are Amazon and Moonshine (not to be confused with Moonshine Mine on South Arm of Cholmondeley Sound; Maas et al. 1995). Dolomi is a former mining camp, located at the head of Dolomi Bay, that was established in the 1890s. It had a post office which was open from 1906-1926 (AHRS Card 1986). Dolomi was a Haida summer village before the mining era (Goldschmidt and Haas 1946) and was used by Tlingit and Haida for commercial fishing historically.

North Arm Moira Sound

The old town site of Baldwin is within the project area and is located on the north shore of the North Arm of Moira Sound in the vicinity of Nowiskay Cove. This was a marble quarry claimed in November 1901. In 1905 a wharf and buildings were constructed and an 80-horsepower boiler, engines, lathes, channelers, a Burleigh steamer, and drills were brought onto the site. The wharf was 60 x 60 feet with a tramway to the quarry 500 feet above sea level, where a 500 foot tunnel was mined into the hillside. By October 1905, a post office was established. Work was stopped the following year and in 1907 the equipment was shipped out and the post office closed (Roppel 1991).

Previous Cultural Resource Surveys in the Chasina Project Area

In 1980, J. Jones and V. Slajer (1980) inspected the route that was proposed for the road system along the shore from the area north of Lancaster Cove down to Kitkun Bay. This is the 4680 road and associated spurs. They also surveyed the area for the log dump south of Lancaster Cove. The crew members walked 35 meters on each side of the survey center line. Test pits were excavated in areas of potentially high sensitivity, such as creeks. No cultural resources other than spring-board stumps and a culturally modified tree were found during this survey.

Campbell (1984a) surveyed the coastal fringe along the eastern shore of Kitkun Bay and in the bays north of Kitkun Bay to Lancaster Cove and south of Chasina Point. The coastline was surveyed by one person from the shoreline to 500 - 870 meters inland. Campbell states that there were frequent soil probes and the rootwads of trees were checked for evidence of buried cultural deposits.

A survey for the Kootznoowoo Native Corporation Land exchange was conducted in the same general area in 1993 by Forest Service archaeologists Ralph Lively and Allison Young (1993). The archaeologists walked in 15m wide transects and subsurface tests with soil probes were conducted every 25 meters.

Because of the intensive previous survey activity which took place in the Lancaster Cove area, surveys in 1995 concentrated in South Arm and the Clarence Strait coast of the Chasina timber sale area. It appears that Port Johnson and North Arm have not been formally surveyed, although there has been the occasional visit by archaeologists (Fifield, pers. comm.).

Chasina Cultural Resource Inventory

The cultural resource study for the Chasina Project Area was designed to meet federal and state resource management legislation as summarized in regulations prepared by the President's Advisory Council on Historic Preservation (36 CFR, Part 800). These regulations encompass the requirements of Section 106 of the National Historic Preservation Act of 1966, the National Environmental Policy Act of 1969, and FSM 2300, among other laws and regulations. The inventory plan, consistent with the programmatic memorandum of agreement between the Alaska Region of the Forest Service and the Alaska State Historic Preservation Officer, includes intensive pedestrian survey of all areas of direct effects within high sensitivity areas for cultural resources and a judgmental sample of high sensitivity areas in areas of indirect effects. High sensitivity areas are all areas between mean low water and 100 feet in elevation. The high sensitivity areas also include mineralized areas; river and lake systems that provide passage to larger land masses; streams and lakes with anadromous fish runs; fossil marine, river, and lake terrace systems; karst landforms; areas associated with traditional cultural myths and legends; and raw material sources such as cedar stands and obsidian deposits. Everything not defined as high sensitivity is considered low sensitivity. Additionally, a small sample of unit and road locations in low sensitivity areas is surveyed. Survey methods include a field check of high sensitivity areas by boat to verify sensitivity determinations. Survey is conducted on foot by two or more archaeologists walking parallel transects. Subsurface data is collected using soil probes, test pits, and examination of stream and shoreline cutbanks and root wads.

Survey in 1995 resulted in inventory of sites in the northern portion of the project area and along Clarence Strait. However, additional survey will be conducted in 1996, focusing on

Johnson Cove, North Arm Moira Sound, and proposed harvest units in high sensitivity areas. The results of that work will be incorporated into the Final EIS.

The objectives of this study include:

- location and evaluation of previously recorded cultural resource sites as well as recording and documentation of sites in areas not previously surveyed.
- Evaluation of the significance of located cultural resource sites in terms of the National Register of Historic Sites criteria.
- Determination of potential effects for each project alternative on the significant sites and comparison of the alternatives.
- Recommendation of measures to mitigate potential adverse effects on significant resources and a discussion of the possible effectiveness of the measures.

Project Area Cultural Resources

The project inventory identified a total of 16 cultural resource properties within the project area. In addition, 1995 survey identified locations of several mines which may have historic components, and which deserve further investigation. Ten of the properties were recorded prior to the 1995 field season. These sites were revisited and new observations made, site forms updated, and significance assessed. It should be noted that determinations of eligibility for the National Register of Historic Places are not made in this document. It is certain that additional cultural resource properties will be recorded during the 1996 field season. Completion of the Section 106 process of the National Historic Preservation Act including the presentation of eligibility determinations will be reserved until the complete assemblage of sites is known.

In general, the 16 sites recorded fall into three categories: historic, villages, and shell middens. Table CUL-2 lists these 16 sites. Ten sites represent "historic" activities in the project area within the last century. These include a cannery, several mining sites (camps, diggings, and a tram), logging camps, and work areas. Two sites are labeled "villages" and appear to be Haida settlements (more likely seasonal) of the mid-to-late 19th century. Two rockshelter sites were found, both containing cultural deposits. KET-447, in particular holds a lot of potential for understanding a facet of the seasonal lifestyle of the last three millennia. Radiocarbon samples from that site returned dates spanning the last 2,800 years. The second rockshelter (CRG-382) is located adjacent to a stone fish trap and was dated to 730 years before present. The last two sites are noted as "shell middens" and probably represent short-term occupations.

It is fully expected that additional sites in all three categories will be recorded during 1996 field investigations. Survey to be accomplished in 1996 includes Johnson Cover, North Arm Moira Sound, and selected harvest units within the project area.

Table CUL-2
Known Cultural Resource Properties Within the Chasina Project Area

Property Number			
Field #	**AHRS #**	**Site Type**	**Cultural Affiliation**
Chasina-1995-01	CRG-448	collapsed structure	Historic
Chasina-1995-02	CRG-449	tramway	Historic
Chasina-1995-03	CRG-450	logging camp/shipwreck	Historic
Chasina-1995-05	CRG-451	mine	Historic
Chasina-1995-04	KET-446	logging	Modern/Historic
Chasina-1995-06	KET-447	rockshelter	Aboriginal
	CRG-007	cannery	Historic
	CRG-008	village	Aboriginal
	CRG-013	quarry/town	Historic
	CRG-022	village	Aboriginal
	CRG-341	cabin/log cribbing	Modern/Historic
	CRG-382	fish trap/rockshelter	Aboriginal
	CRG-393	shell midden	Aboriginal
	CRG-394	cabin	Historic
	CRG-395	pilings	Historic
	CRG-396	shell midden	Aboriginal

Effects of the Alternatives

Introduction

Documentation of cultural resources, and preservation and protection of National Register of Historic Places eligible properties, are Forest Service objectives in the current project. Avoidance and preservation in place is the preferred means of treating significant historic properties. When avoidance and preservation are not viable management options, measures are implemented to recover data as a way of mitigating effects to these properties.

Direct and Indirect Effects

Direct impacts to cultural resources may result from such activities as road building, logging, or construction of log transfer facilities. While natural processes such as erosion and redeposition can also adversely affect cultural resources, such processes can be accelerated as a result of logging related activities. Indirect impacts to resources, such as increased access to the area or change in stream flow or sediment loads, may result from logging or road building. Additionally, increased access to an area containing significant cultural resources due to trail development can result in direct and indirect effects and will be addressed through additional compliance survey.

Intensive cultural resource inventory of areas that have high probability of containing cultural resources is an important means of protecting these resources. Surveys in 1995 focused on high sensitivity areas in the project area. Helicopter reconnaissance was used to identify these areas. Boat survey of the shoreline was conducted on approximately 60 miles of coastline. Sixteen miles of coastline was surveyed on foot. Survey in 1996 will complete coverage of a sample of the coastal high sensitivity zone, identified inland pockets of high sensitivity, and a small sample of areas of direct impact in the low sensitivity zone.

Effects on Known Significant Cultural Resources
The following statements summarize presumed effects on known significant cultural resource from logging and road construction being considered for the various alternatives.

Alternative 1
No action will result in no effect to cultural resources.

Alternative 2
There are no known direct or indirect impacts. Indirect impacts are possible in Johnson Cove. Indirect impacts result from increased visitation which can lead to destruction of significant cultural resources either inadvertently, such as through compaction and erosion, or intentionally, by vandalism and looting. Intentional vandalism may include defacing ancient rock art, application of modern graffiti to above ground historic structures, and intentional damage to or destruction of other cultural features. The difference between this type of vandalism and others is that the damage is generally irreversible. Valuable scientific information and pieces of our national heritage are lost forever. Site looting might include removal of items for personal and/or financial gain. Studies suggest that looting most often occurs in isolated areas, such as in Wilderness, where law enforcement presence is minimal and the likelihood of witnesses and discovery is low (Christensen et al. 1992). The 1996 survey results are needed for complete assessment.

Alternative 3
There is a potential for indirect effect in 679-409 and indirect effects in Johnson Cove (see above).

Alternative 4
There are potential indirect effects at the south end of South Arm Cholmondeley Sound, in Johnson Cove, and in North Arm Moira Sound. There may also be indirect effects in 679-355.

Alternative 5
There is a possible direct effect in 679-355 that needs assessment in 1996. There may be indirect effects in 679-341 and 679-409 in addition to the potential indirect effects in Johnson Cove and North Arm Moira Sound, mentioned above.

Alternative 6
All of the above apply to this alternative.

The preferred management approach for cultural resource properties by the Forest Service and other agencies is avoidance. Logging operators should be urged to avoid moving logs near shore areas to avoid additional impacts to shoreline properties. In addition, operators should be asked to discourage any increase in human activity in the coastal area. To address avoidance and preservation concerns, Forest Service personnel should monitor the area during logging activities. If disturbance occurs or is imminent, the Forest Archaeologist will develop a plan to protect properties or mitigate the effects of any impacts.

In the unlikely event that avoidance is not feasible or practicable during project implementation, mitigation of impacts to the properties through data recovery plans will be based on the qualities that make the properties eligible for the National Register of Historic Places.

In cases where development is planned in areas of high cultural resource sensitivity or in the vicinity of known cultural resource sites, the Forest Service should develop and implement a plan for monitoring known, significant resources and surveying for previously unknown properties. If the monitoring program documents effects to properties, then measures should be developed to mitigate those effects. And, if new properties are exposed, they should be recorded and evaluated for National Register of Historic Places eligibility.

Cumulative Effects

Impacts from natural decay, landscape changes, private developments, and timber management activities collectively result in the loss of nonrenewable cultural resources in Southeast Alaska. Development activities of all kinds pose particular threats to cultural resources because such activities tend to be located in the same places that cultural resources are found, such as sheltered coastal settings.

It is impossible to determine the exact nature of resources that may have been previously disturbed in the Chasina Project Area. Intensive cultural resource investigations and mitigation measures have been implemented only since the 1980s. The implementation of updated research and survey designs, based upon the results of previous work and current methods and techniques, combined with various mitigation measures, will preserve significant properties and provide data that will guide future research and management activities. In

addition, current management approaches for Beach Fringe/Estuary and Stream/Lake Protection should benefit cultural resources through decreased activity in high sensitivity areas and reduced indirect effects such as sedimentation of resources.

Recreation, Wilderness, Wild and Scenic Rivers, and Roadless Areas

Key Terms

Developed recreation—a type of recreation that occurs where more facilities and amenities are incorporated into a site to accommodate intensive recreation activities in a defined area.
Dispersed recreation—a type of recreation use that requires few improvements or specific developed sites and may occur over a wide area. This type of recreation involves activities related to roads, trails, and undeveloped waterways and beaches.
Primitive (P)—an unmodified environment of fairly large size. Interaction between users is very low and evidence of other users is minimal. The area is essentially free from evidence of human-induced restrictions and controls. Motorized use is not present except for infrequent boats and plans.
Recreation Opportunity Spectrum (ROS)—provides a framework for stratifying and defining classes of outdoor recreation environments. The spectrum ranges from primitive to urban settings. The spectrum considers a variety of factors such as: access, remoteness, social encounters, visitor management, visitor impacts, and naturalness. ROS settings are defined in the glossary in Chapter 4, under the glossary term "Recreation Opportunity Spectrum (ROS).
Recreation place—a geographic area having one or more physical characteristics attractive to people engaging in outdoor activities. A variety of activities may occur in any recreation place.
Recreation site—a specific location where a particular activity is known to occur, or is well suited for an activity to occur in the future. (Sites are designated as existing or potential.) A recreation site is smaller than a recreation place.
Roaded Modified (RM)—a natural environment that has been substantially modified particularly by vegetative manipulation. There is strong evidence of roads and/or highways. Frequency of contact is low to moderate.
Roaded Natural (RN)—a natural appearing environment with moderate evidence of the sights and sounds of humans. Such evidence usually harmonizes with the natural environment. Interaction between users may be moderate to high with evidence of other users prevalent. Motorized use is allowed.
Roadless area—an area of undeveloped public land within which there are no improved roads maintained for travel by means of motorized vehicles intended for highway use.
Semi-Primitive Motorized (SPM)—a natural or natural-appearing environment of moderate to large size. Interaction between users is low, but there is often evidence of other users. Local roads used for other resource management activities may be present, or along saltwater shorelines there may be extensive motorized boat traffic.

Semi-Primitive Non-Motorized (SPNM)—a natural or natural appearing environment of moderate to large size. Concentrations of users is low, but there is often evidence of other users. No roads are present in the area.
Wild and Scenic River—Rivers or sections of rivers designated by congressional action under the 1968 Wild and Scenic Rivers Act or by an act of the Legislature of the states through which they flow.
Wilderness—Areas designated by congressional action under the 1964 Wilderness Act of by the Tongass Timber Reform Act and/or the Alaska National Interest Lands Claim Act. There are areas of undeveloped federal land retaining its primeval character and influence. These areas generally do not contain permanent improvements or human habitation, except as permitted by the acts.

Affected Environment — Recreation

Introduction

Describe physical characteristics of project area and how it is situated in relationship to broader view of island.

Current Use

Recreation use in the Chasina Project Area is predominately dispersed and saltwater-based. Some activity, such as hunting, occurs along the road corridors. Typical activities include boating, fishing, camping, hunting, off-road vehicle use, beach combing, and viewing scenery and wildlife.

There are several identified recreation sites located in the Chasina Project Area. Some of the recreation sites are located on lands now owned and managed by Kootznoowoo Native Corporation or the State of Alaska. Several additional recreation sites were located during a field review of the area.

There are no developed recreation facilities in the project area; the closest recreation developments are Kegan Creek and Kegan Cove cabins, located to the south in Moira Sound.

Timber harvest is evident throughout the project area. There is a small scattering of float houses, predominantly associated with logging camps.

Recreation Demand

Several factors influence recreation demand in an area, such as: population dynamics, lifestyle and interests of the population, and ease of access to recreation.

Statistics from the Alaska Department of Labor (1995) indicate a general trend of population growth in the Prince of Wales area during the past six years. In 1990, the Prince of Wales census subarea listed 4,652 residents; in 1995, the same area listed 5,154 residents. According to the State Demographer, the population statistics do not reflect the transitory population numbers. Thus, actual population is estimated to be higher in this area.

Boating, fishing, hunting, and beach combing are traditionally popular recreation activities on the Tongass National Forest (Analysis of the Management Situation 1990). In addition to these typical activities, viewing scenery, driving for pleasure, camping, and use of the recreation cabins are important activities on Craig Ranger District (USFS Recreation Information Management (RIM) Report 1995).

While the demand for dispersed undeveloped recreation opportunities is likely to continue, there is also an increasing interest in developed recreation. A public survey conducted in 1992 (Holman for USDA Forest Service), indicated a high level of support for developing campgrounds and additional trails on the island. There was also a high level of interest in development of additional information guides and brochures.

In addition to an increasing population, visitation and tourism is increasing on Prince of Wales Island. Travelers arrive by floatplane, boat, and ferry. Independent travelers often arrive by ferry, and bring passenger vehicles or recreation vehicles (RVs). Other independent travelers arrive by private, non-commercial boat (usually during the summer months). Some visitors come to the island on package vacations sponsored by resorts which typically include activities such as guided fishing trips. During summer months, the harbors support many non-commercial, leisure, and fishing vessels. The harbors also support a large, year-round, commercial fleet.

Recreation Places and Recreation Sites

The recreation planning personnel on the Tongass National Forest use the following two terms to describe the areas where recreation activities occur.

- **recreation place**—is a geographic area having one or more physical characteristics attractive to people engaging in outdoor activities. A variety of activities may occur within any recreation place.

- **recreation site**—is a specific location where a particular activity is known to occur, or is well suited for an activity to occur in the future (the sites are designated as existing or potential). Examples of recreation sites include a campsite, an anchorage, a public use cabin, a vantage point with a good view, the site of a trap line, and known hunting areas. There may be several recreation sites within a recreation place.

Description of Recreation Sites

Recreation sites recorded in the Ketchikan Area geographic information system (GIS) recreation layer were reviewed during the 1995 field season. Some of the sites are on lands no longer managed by the Forest Service. Sites that are located on lands managed by the State of Alaska will be considered available for public recreation and are included in this analysis. Sites located on private land, including land owned and managed by Native corporations, will not be considered available for public recreation.

In addition to verifying the previously recorded recreation sites, the GIS recreation layer was updated to include recreation sites and uses not previously inventoried. These sites are estimated to be representative of recreation sites and activities in and adjacent to the project area.

Existing and potential recreation sites in the Chasina Project Area are described below and displayed in Figure REC-1.

Existing Sites

- **51131 Anchorage—Head of Dora Bay (RP 51166)**
  Boating is the primary activity in the area. There is a small parcel of National Forest System land at the head of the bay; the remainder of Dora Bay is owned and managed by Kootznoowoo Native Corporation. The majority of Dora Bay has had extensive timber harvest.

- **51133 Observation Site—Scenery—East of Babe Islands (RP 51169)**
  Viewing scenery and wildlife, boating, beachcombing, and other general day use activities occur at this site. The site is located on lands managed by the State of Alaska.

- **51134 Observation Site—Scenery—East of Babe Islands (RP 51169)**
  Area is suitable for dispersed campsite, however no evidence of prior use as such was observed. Boating, beachcombing, wildlife observation, and viewing scenery occur at this site which is located on lands managed by the State of Alaska.

- **51135 Anchorage—South of Lancaster Cove (RP 51168)**
  Activities associated with the site include: viewing scenery, observing wildlife, boating, and hunting small game. The site is located adjacent to National Forest System lands.

- **51185 Observation Site—Scenery—South of Lancaster Cove (RP 51168)**
  Activities in the area include boating, viewing scenery and wildlife, and small game hunting. The site is located on National Forest System lands.

- **51302 Anchorage—Lancaster Cove (RP 51168)**
  Boating, viewing wildlife and scenery, and small game hunting occur in the area. There are indications of old trap line in the area. The site is located on National Forest System lands.

- **51300 Dispersed Camp Site—North of Lancaster Cove (RP 51250)**
  Beachcombing and dispersed camping are the primary activities for the area. The site is located on National Forest System lands.

- **51136 Anchorage—French Harbor (RP 51170)**
  Boating, beachcombing and associated day use activities occur in the area. The site is located adjacent to National Forest System lands.

- **51137 Observation Site—Scenery—South of French Harbor (RP 51170)**
  Boating, beachcombing, viewing scenery, picnicking, and other general day use activities occur at this site. The site is adjacent to lands managed by Kootznoowoo Native Corporation. Recreation activities occur below mean high tide or on the water. This site will be retained in the data base.

- **51138 Observation Site—Scenery—South of French Harbor (RP 51170)**
  Boating, beachcombing, viewing scenery, picnicking, and other general day use activities occur at this site. The site is located adjacent to lands managed by Kootznoowoo Native Corporation. Recreation activities occur below mean high tide or on the water. This site will be retained in the data base.

- **51303 Boating Site—Dutch Harbor (RP 51170)**
Activities associated with the site include: boating, beachcombing, viewing scenery, observing wildlife, dispersed camping, and big game hunting. The site is located on National Forest System lands.

- **51139 Anchorage—Port Johnson (RP 51171)**
Boating and big game hunting are inventoried activities for the area. This site is located on National Forest System lands.

- **51140 Dispersed Camp Site—Cannery Cove—Immediately outside planning boundary (RP 51172.03)**
Boating, dispersed camping, viewing scenery and wildlife, beachcombing, and big game hunting are inventoried activities for the area. This site is located on National Forest System lands.

- **51141 Anchorage—Northwest of Cannery Cove—Immediately outside planning boundary (RP 51172.03)**
Boating, dispersed camping, viewing scenery, observing wildlife, beachcombing, and big game hunting are inventoried activities for the area. The site is located on National Forest System lands.

- **51142 Observation Site—Scenery—Nowiskay Cove (RP 51172.01)**
Inventoried activities include: dispersed camping, viewing wildlife and scenery, beachcombing, big game hunting, and boating. The site may also be used as an anchorage because it has two gravel beaches with best use at low tide. This site is located on National Forest System lands.

- **51143 Anchorage—Aiken Cove—Immediately outside planning boundary (RP 51172.02)**
Boating, dispersed camping, viewing scenery and wildlife, beachcombing, and big game hunting are inventoried activities for the area. There is an anadromous stream at head of cove and steep beaches near mouth of cove. The site is located adjacent to National Forest System lands.

- **51144 Observation Site—Scenery—Aiken Cove—Immediately outside planning boundary (RP 51172.02)**
Boating, dispersed camping, viewing scenery and wildlife, beachcombing, and big game hunting are inventoried activities for the area. The site is located adjacent to National Forest System lands.

- **51301 Dispersed Camp Site—East Side of Kitkun Bay (RP 51322)**
Waterfowl hunting, boating, viewing scenery, and wildlife observation are the primary activities for the area. During the 1995 field season, shrimp pots were observed being set in the bay.

- **51304 Dispersed Camp Site—South of Chasina Anchorage (RP 51309)**
Dispersed camping, beachcombing, small game hunting, viewing scenery, and boating occur in the area. The site has a gravel beach with a campsite in the trees. The site is located on National Forest System lands.

- **51305 Anchorage—Adjacent to Chasina Island (RP 51323)**
  Beachcombing, dispersed camping, and picnicking occur in the area. The campsite is at low tide during calm weather. The anchorage is adjacent to National Forest System lands.

- **51307 Observation Site—Wildlife—Southeast of Chasina Point (RP 51310)**
  Activities at the site include: viewing scenery and wildlife (Dall porpoise frequently in the area), boating, beachcombing, and small game hunting. The site is located adjacent to National Forest System Lands.

- **51308 Fishing Site—East tip of South Arm of Cholmondeley Sound (RP 51173.01)**
  Stream fishing, dispersed camping, viewing wildlife, and hiking occur in the area. Abandoned cabins are located at the site. The site is located on National Forest System Lands.

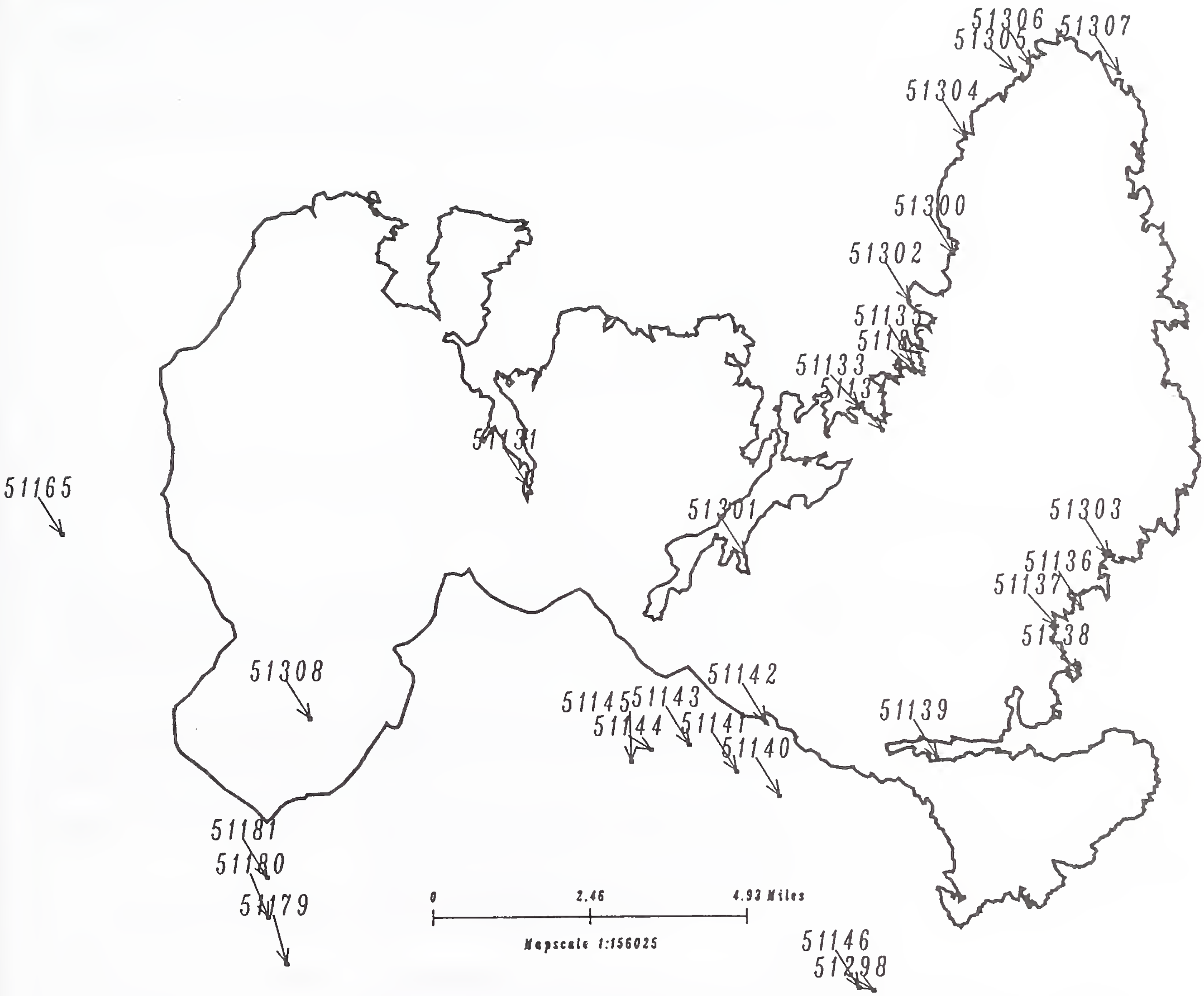
Potential Sites

- **51130 Dispersed Campsite (RP 51166) and 51132 Recreation Shelter (RP 51166)**
  These sites are located on lands now owned and managed by Kootznoowoo Native Corporation. Extensive timber harvest has occurred in the area. The sites will probably not be used as recreation sites because they exist on private property. These sites will be removed from the data base.

- **51145 Dispersed Camp Site—Aiken Cove—Immediately outside planning boundary (RP 51172.02)**
  Boating, dispersed camping, viewing scenery and wildlife, beachcombing, and big game hunting are inventoried activities for the area. The site is located on National Forest System lands.

- **51306 Dispersed Camp Site—Southwest of Chasina Point (RP 51309)**
  Potential activities at the site include: viewing scenery, boating, dispersed camping, beachcombing, and small game hunting. This site is on an open second-growth stand. The site is located on National Forest System lands.

Figure REC-1
Existing and Potential Recreation Sites



Recreation Opportunity Spectrum and Setting Indicators

The process used to classify recreation opportunities on National Forest System lands is the Recreation Opportunity Spectrum (ROS). The ROS process is not a land management system, but rather is a method used to inventory an area's potential recreational opportunities. This system can be used to evaluate the changes that can occur in a given area as a result of different management prescriptions. The recreation report for this project will be presented using the ROS outline.

The ROS offers a framework for understanding the relationships and interactions among the setting indicators. The setting indicators are used to develop the opportunity spectrum classifications ranging from Primitive (P) to Urban (U), defined in the glossary in Chapter 4.

The ROS classifications currently identified for the Chasina Timber Sale Area include Primitive (P), Semi-Primitive Non-Motorized (SPNM), Semi-Primitive Motorized (SPM), and Roaded Modified (RM).

The Recreation Opportunity Spectrum is formulated by a variety of factors or "setting indicators" including:

1. access
2. remoteness
3. social encounters
4. visitor management
5. facilities and management
6. visitor impacts
7. naturalness

Each of the following setting indicators assists in describing the existing condition.

Access

Access includes type and mode of travel.

Marine access via private boat is the primary mode of recreation travel to the Chasina timber sale area. Some travel occurs in the project area via float plane, helicopter, and commercial boat.

Minimal foot travel is expected to occur in the area. Beach combing and hunting are the primary pedestrian activities. There are no developed trails in the project area, nor are there any known inland recreation destinations or recreation sites on National Forest System Lands.

The road system, developed for timber harvest, is used as a travel corridor for some recreation activities such as hunting and driving off-road vehicles.

The existing modes of access are consistent with the ROS classifications for the area.

Remoteness

Remoteness refers to the extent to which individuals perceive themselves removed from the sights and sounds of human activity.

Human activity in varying degrees is apparent throughout the project area. Boat traffic, roads, timber harvest, and human structures are the most common and apparent infringements upon remoteness.

- **Boat traffic**—the entire coastline is exposed to motorized boating. Sights and sounds associated with boating are most common along the larger bodies of water such as Clarence Strait, Cholmondeley Sound, and Dora Bay. Clarence Strait is a heavily traveled water route; the Alaska Marine Highway, cruise ships, and a myriad of other boat traffic travels Clarence Strait daily. Rocky coves and the heads of bays typically receive less boat traffic.

- **Roads**—a small, isolated road network exists from the South Arm of Cholmondeley Sound, Divide Head south to the east side of Dora Bay, and from the east side of Kitkun Bay to Lancaster Cove and Port Johnson. The roads and road corridors have a localized impact on remoteness. Because the roads are lightly traveled, traffic noise is negligible except in areas of concentrated activity, such as timber harvest (discussed below).

- **Timber Harvest**—the Chasina timber sale area is adjacent to several large land selections made by Kootznoowoo Native Corporation. The Kootznoowoo Native Corporation Lands are heavily harvested and additional harvest activity was underway during the 1995 field season. The sights and sounds associated with timber harvest are most apparent in the South Arm of Cholmondeley Sound, on the south shores of Cholmondeley Sound, in Clarence Strait, Port Johnson, and in Dolomite Bay. Helicopters, log trucks, log transfer facilities (LTFs), and other vehicles and facilities are required for timber harvest.

- **Human Structures**—private homes and logging camps are dispersed in the project area; most are located on private land or on shores associated with private land. For example, structures are located in the South Arm of Cholmondeley Sound, Dora Bay, and Dolomi Bay.

The existing ROS classifications for the area generally account for the impacts to remoteness. However, the classifications were revised to reflect impacts from adjacent land ownerships.

Social Encounters

This factor refers to the number and type of recreationists met along travel ways or camped within sight or sound of each other. This setting indicator measures the extent to which an area provides experiences such as solitude or the opportunity for social interaction.

Social encounters are most typical on saltwater or in the tidal zone and are extremely low inland. Social encounters with other recreationists are more probable in the summer months and during the hunting seasons. Commercial traffic on saltwater continues year-round, but is most concentrated in the summer months. The social encounters are typically congruent with the ROS classification of the area.

Visitor Management

Visitor Management includes the degree to which visitors are regulated and controlled (via physical barriers or regulations—such as permits), as well as the level of information and services provided for visitor enjoyment.

General forest regulations apply; there are no regulations or closures particular to the project area. No information or visitor facilities are provided in the project area. The level of visitor management is consistent with the ROS classifications of the area.

Facilities and Site Management

This indicator refers to the level of site development. There are no developed recreation facilities in the project area; the closest recreation developments are Kegan Creek and Kegan Cove cabins, located to the south in Moira Sound. The levels of facility development and site management are consistent with the ROS classifications of the area.

Visitor Impacts

This factor refers to the impacts of visitor use on the environment, how much change would be allowed, and which actions are appropriate for management.

Maintaining air, water, and noise quality standards due to visitor impacts is important in all ROS classes. Recreation impacts to air, water, or ambient sound qualities are negligible in the project area. Most sites show no sign of human impact. A few dispersed campsites display mild human impacts, such as litter, fire scars, and/or trampled or cut vegetation. The level of visitor impact is consistent with the ROS classifications of the area.

Naturalness

Naturalness refers to the degree of naturalness of the setting as it relates to visual quality objectives (VQOs).

The setting in the project area, including National Forest, private, and State lands, varies from unaltered to drastically altered (refer to definitions in the Scenic Resources section of this chapter). Heavily altered and drastically altered conditions are considered inconsistent with roaded natural or any of the more primitive ROS classifications.

A large portion of the landscape has had extensive timber harvest activity, including Dora Bay, the east side of the South Arm of Cholmondeley Sound, portions of Kitkun Bay, the west side of Lancaster Cove, portions of the peninsula along Clarence Strait, and in the Dolomi Bay area.

The North Arm of Moira Sound has had little recent timber harvest activity. There is evidence of historic timber harvest in the area; tree stumps notched for springboards are visible throughout the arm (noted in Cannery Cove and Nowiskay Bay).

Eudora Mountain is a predominant scenic feature and may be viewed from many locations throughout the North Arm of Moira Sound. The landscape appears predominantly undisturbed.

Effects of Alternatives — Recreation

Introduction

Timber management activities can change recreation settings, and thus have an effect on types of recreation activities available, the use of recreation sites, and the quality of the recreation experience. Timber harvest activities generally affect the visual character of recreation

settings, and open previously inaccessible non-roaded areas to motor vehicles. The character of the landscape and the new accessibility usually results in changes in the ROS settings. This section discusses how the alternatives potentially would affect recreation resources in the project area.

Effects Common to all Action Alternatives

Generally, if any of the action alternatives (Alternatives 2-6) were implemented, there would be a reduction in Primitive (P) and Semi-Primitive Non-Motorized (SPNM) settings, and a corresponding increase in the Roaded Modified (RM) setting. The increase in acreage of ROS settings theoretically available for roaded recreation would be accompanied by a decrease in acreage of ROS settings that could theoretically support non-roaded recreation.

While there are differences in intensity and location of activities, there are some general effects applicable to all of the action alternatives. These are described, below, by ROS setting indicator. See individual alternatives later in this chapter for descriptions of effects specific to each proposal.

Access

The mode of transportation to the area (floatplanes/boats) is not expected to change if any of the alternatives are implemented. New roads constructed for timber harvest will not connect to the mainline island road system.

The new roads constructed for timber harvest, may create more potential travel routes for some recreation activities, such as hunting and driving off-road vehicles. It is unlikely this road system will be used for passenger vehicles, unless the road system connects to the Hydaburg Road at some time in the future.

Some patterns of recreation access may change after the proposed timber sale activity; this will vary by alternative.

Remoteness

The timber harvest activity would cause temporary increases in industrial boat traffic, industrial use of roads, and placement and use of camps, and other structures. This increased activity would cause a temporary decrease in the remoteness character of the area.

Longer term impacts to remoteness would include additional miles of roads constructed, additional permanent facility locations, additional landings and log transfer facilities (LTFs) constructed, and change in the character of the area as a result of timber harvest.

Social Encounters and Visitor Management

The proposed timber harvest is not expected to change the level of social encounters in the sale area. Nor is it expected to change the levels or techniques of visitor management in the area. However, some recreation patterns may change after the proposed timber sale.

Facilities and Site Management

A direct effect to site management and facilities near the project area (the cabins in the Kegan Cove area) is not expected due to the proposed timber harvest activities.

Visitor Impacts

Additional miles of roads proposed for construction in the action alternatives could change the levels and types of visitor impacts in the project area.

Naturalness

All action alternatives would effect the natural character of the project area; the location and intensity of the changes would vary with alternative. For a complete analysis, refer to the Scenic Resources section in this chapter.

Effects to Recreation by Alternative

In addition to the effects common to all action alternatives, effects specific to each alternative must be presented. Refer to Table REC-1 for a summary of the acres in each ROS class in the project area, the percentage of National Forest lands of that ROS class for the project area, and the percent change for each ROS class from the existing condition described in Alternative 1. Figures REC-2 through REC-7 display these changes for each alternative.

Table REC-1
ROS Classes by Alternative

	P	SPNM	SPM	RM
Alt. 1 - Existing Condition				
Acres in project Area	10,000	15,800	0	18,200
Percent of NF Lands in the project Area	23	36	0	41
Percent Change from Existing Condition	0	0	0	0
Alt. 2				
Acres in project area	7,000	16,600	0	20,400
Percent of NF Lands in project area	16	38	0	46
Percent Change from Existing Condition	-7	+2	0	+5
Alt. 3				
Acres in project area	3,500	10,200	1,000	29,300
Percent of NF Lands in the project area	8	23	2	67
Percent Change from Existing Condition	-15	-13	+2	+26
Alt. 4				
Acres in project area	1,000	10,500	0	32,500
Percent of NF Lands in the project area	2	24	0	74
Percent Change from Existing Condition	-21	-12	0	+33
Alt. 5				
Acres in project area	3,000	12,200	0	28,800
Percent of NF Lands in the project area	7	28	0	65
Percent Change from Existing Condition	-16	-8	0	+24
Alt. 6				
Acres in project area	0	3,600	0	40,400
Percent of NF Lands in the project area	0	8	0	92
Percent Change from Existing Condition	-23	-28	0	+51

SOURCE: USDA-Forest Service, Ketchikan Area GIS Data Base 1996

Figure REC-2
Changes to ROS Classes for Alternative 1

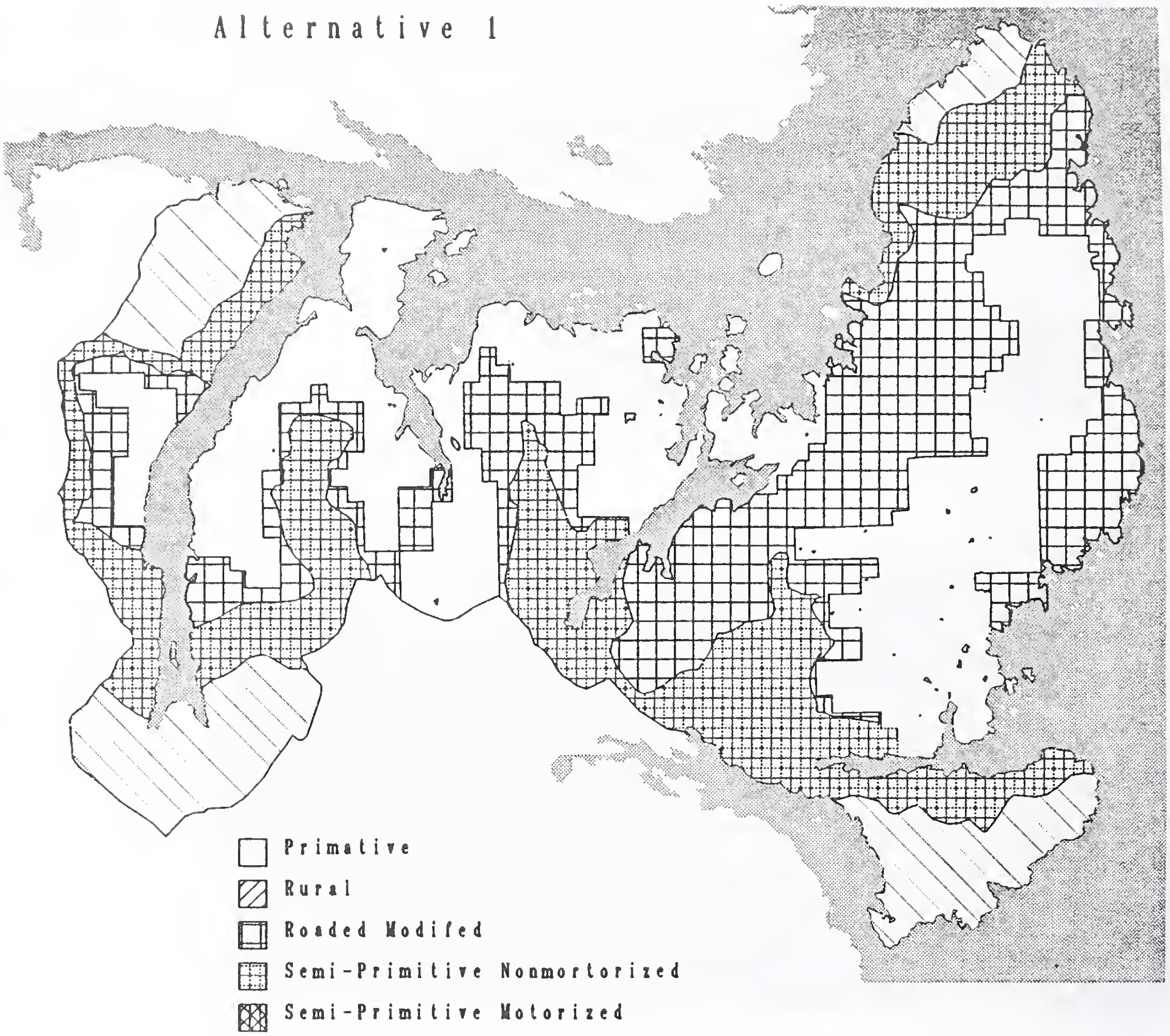


Figure REC-3
Changes to ROS Classes for Alternative 2

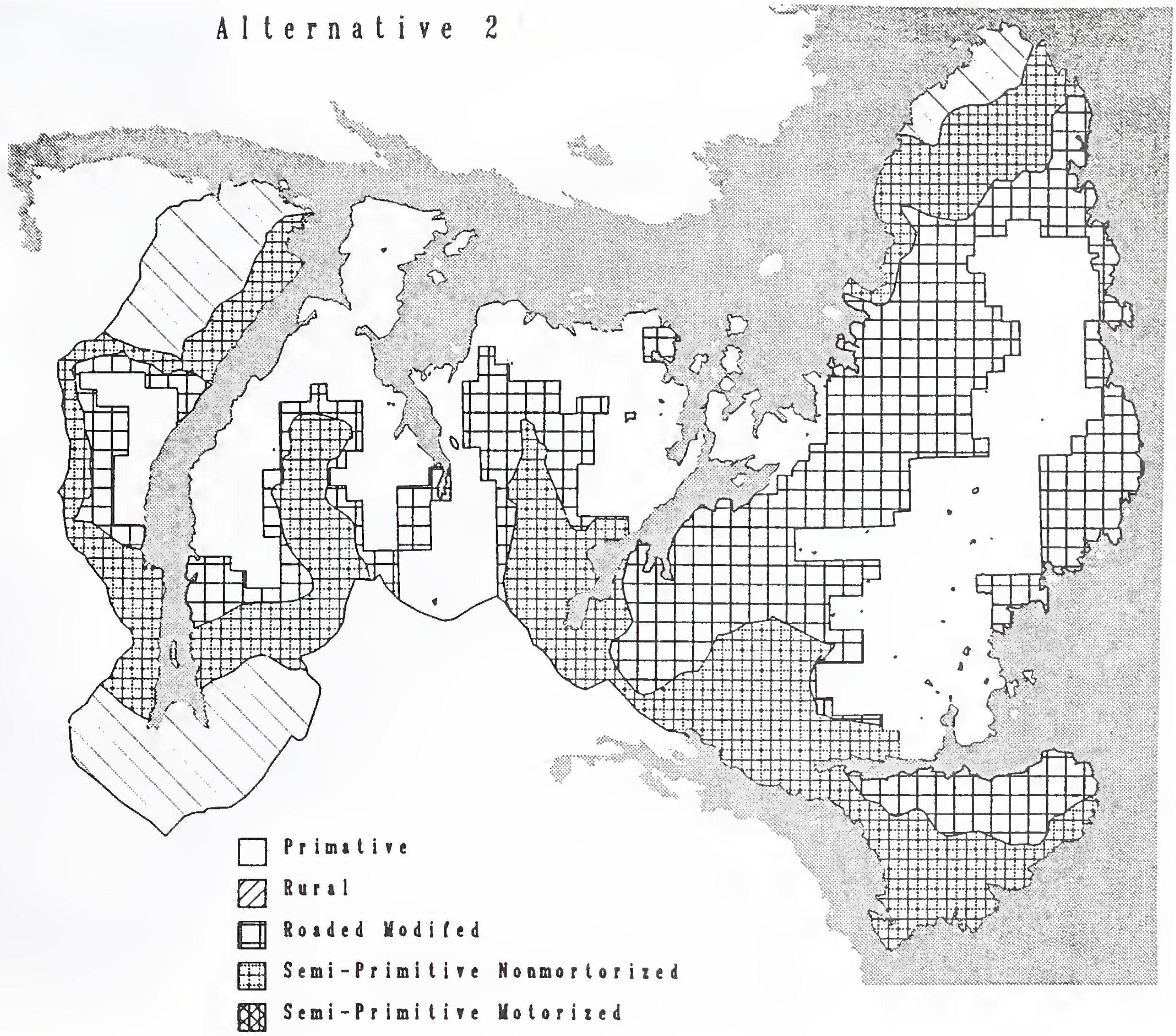


Figure REC-4
Changes to ROS Classes for Alternative 3

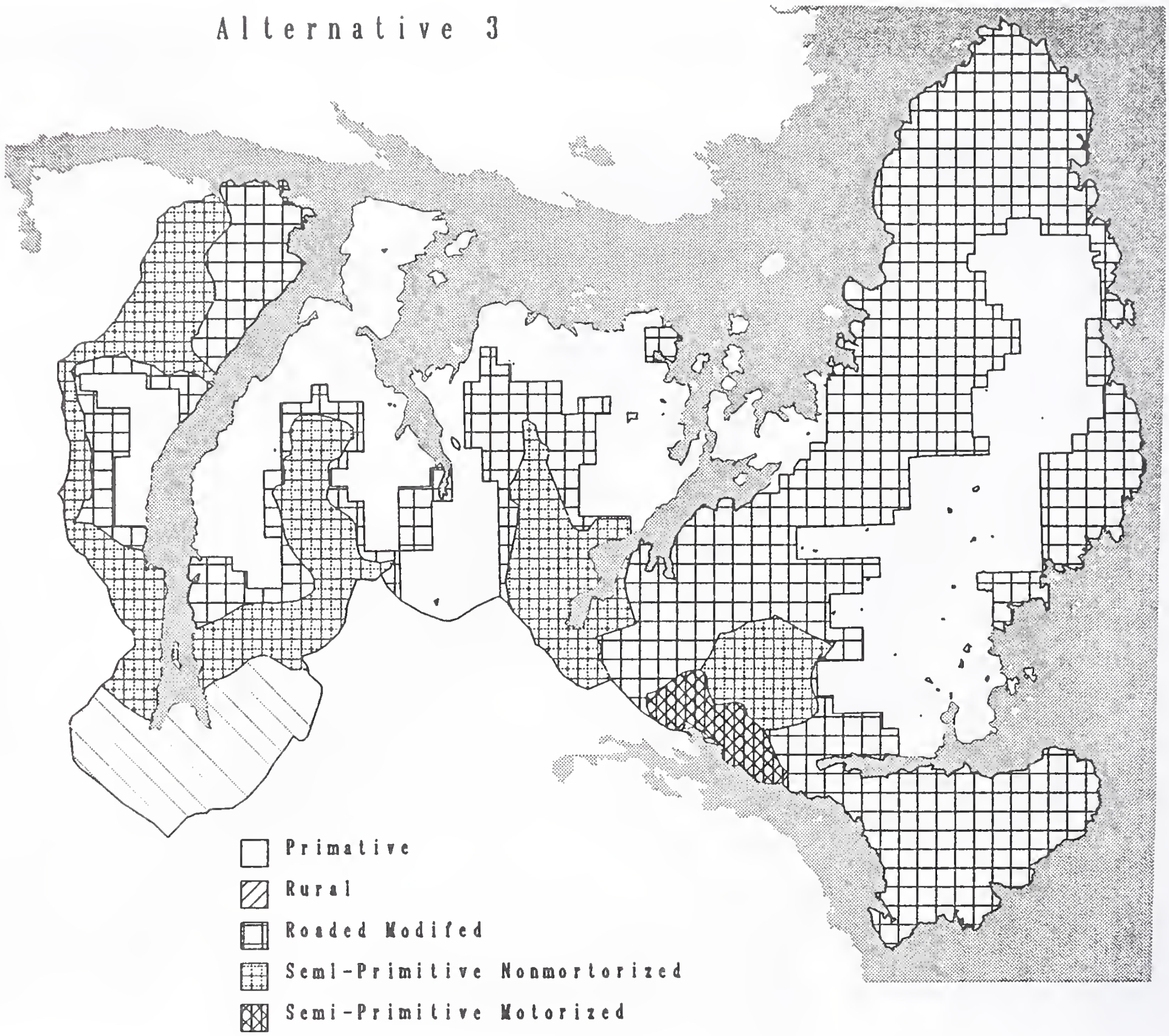


Figure REC-5
Changes to ROS Classes for Alternative 4

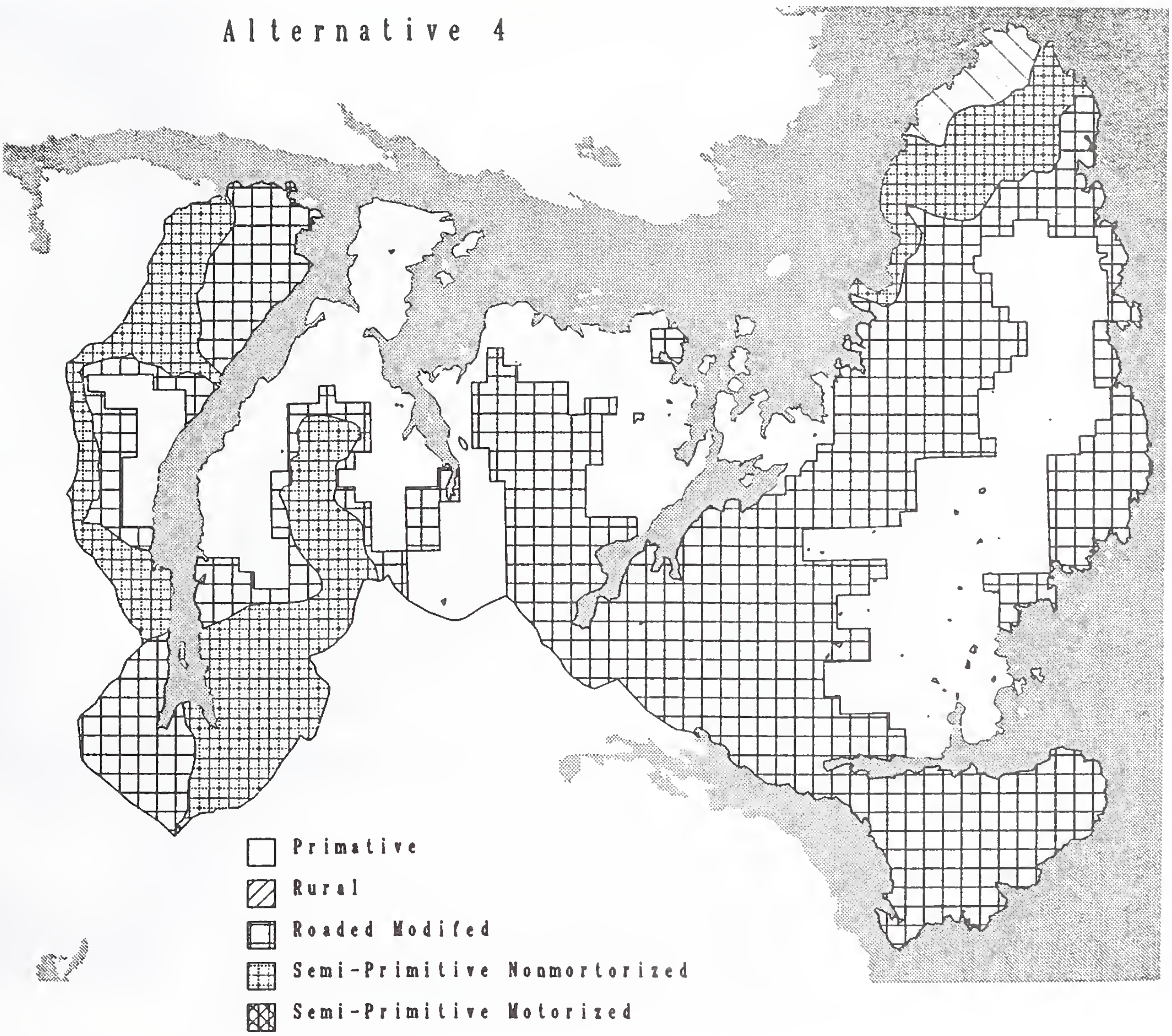


Figure REC-6
Changes to ROS Classes for Alternative 5

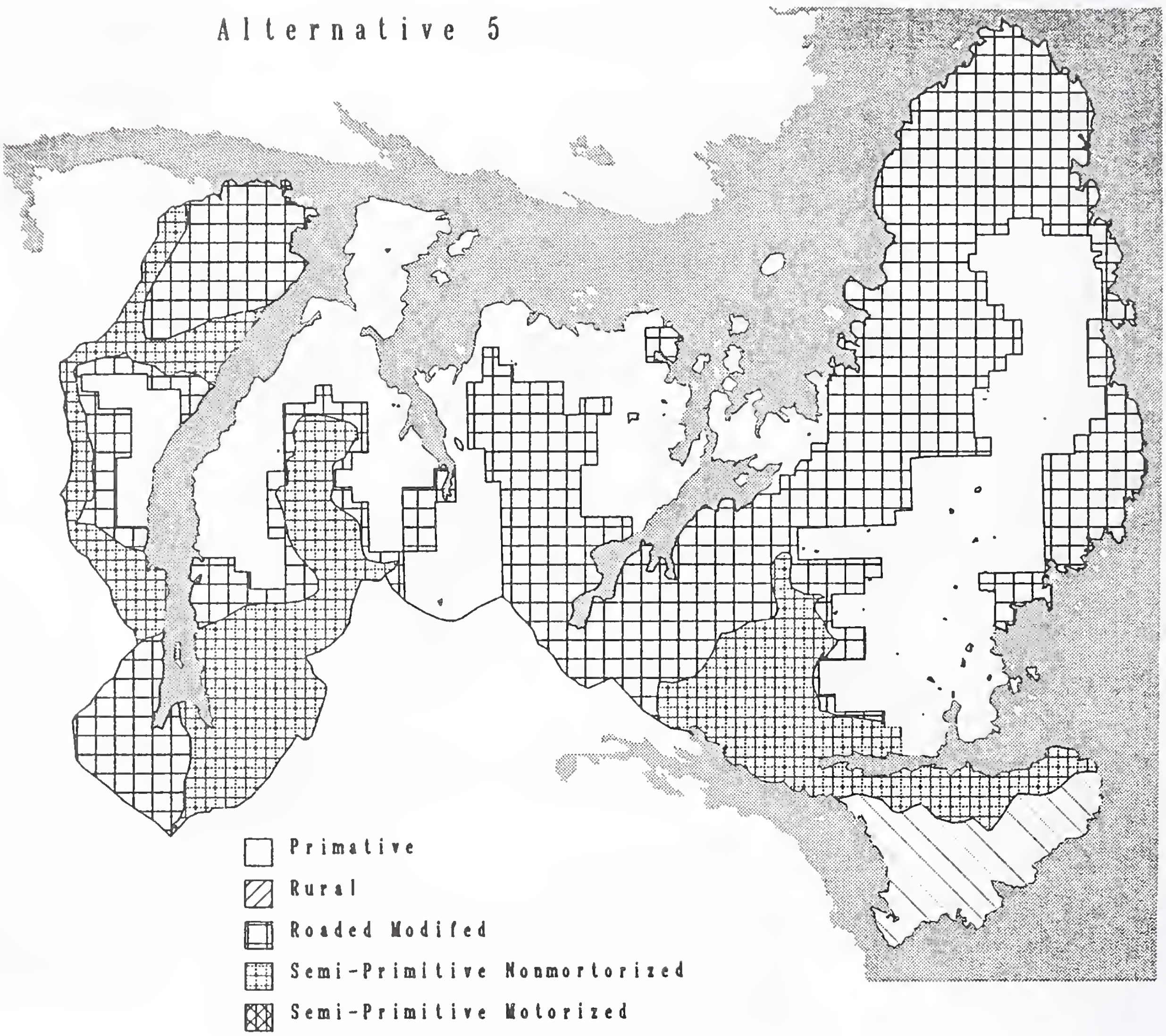


Figure REC-7
Changes to ROS Classes for Alternative 6

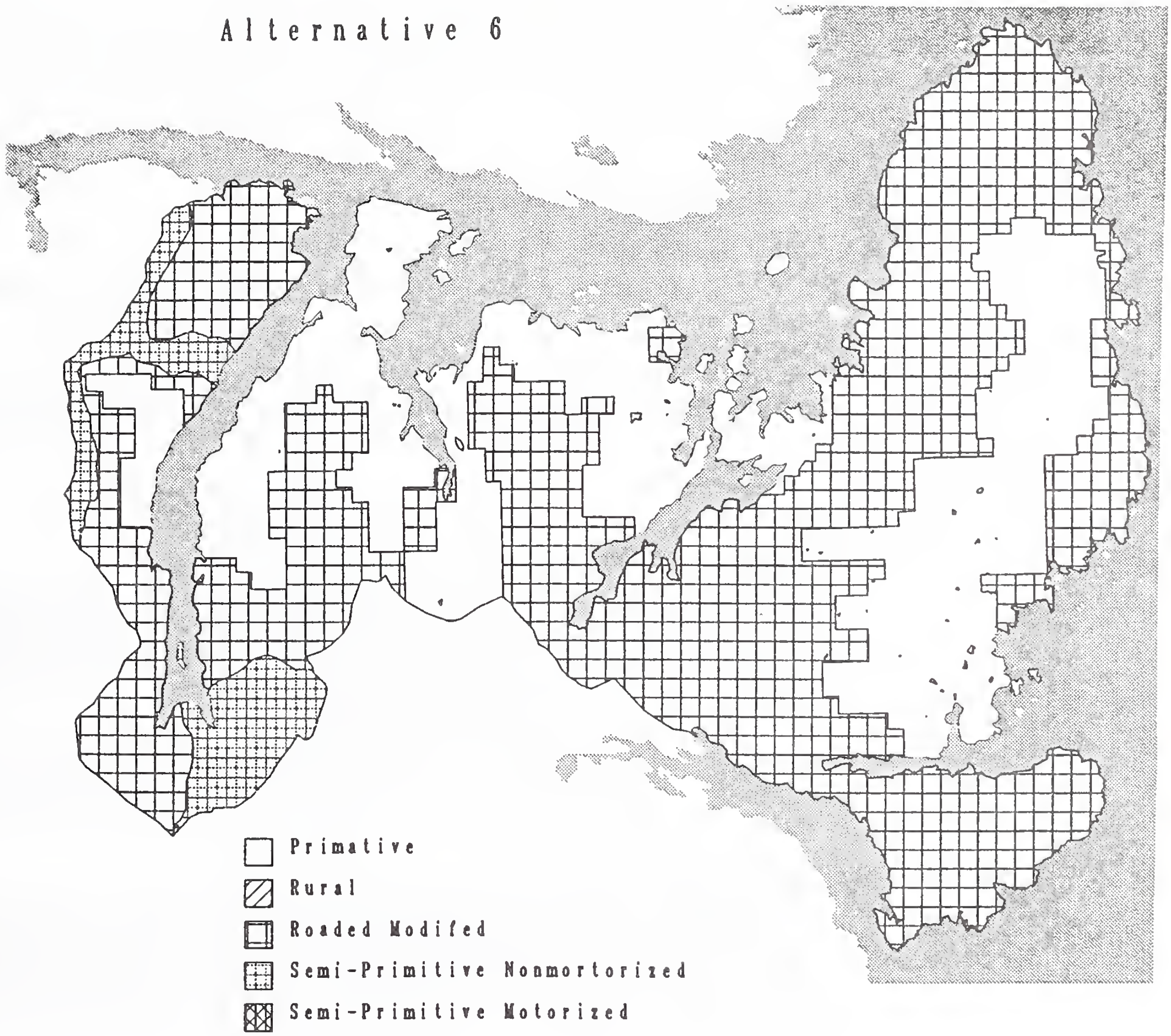


Table REC-2
Recreation Sites with ROS Classes Affected by Alternatives

Alt.	Rec. Sites With Changed ROS Classes	Rec. Sites With Indirect ROS Impacts*
1	none	none
2	51139	none
3	51139, 51307, 51306, 51305, 51304, 51302, 51300	51140, 51141, 51142, 51143, 51144, 51145, 51308
4	51139	51308, 51140, 51141, 51142, 51143, 51144, 51145
5	51300, 51302, 51304, 51305, 51306, 51307	51308
6	51300, 51304, 51305, 51306, 51307, 51139	51302, 513082 51140, 51141, 51142, 51143, 51144, 51145

* Indirect impacts include changes to the ROS class in the immediate vicinity of a recreation site. For example, harvest units at the head of the bay could change the setting of the recreation place, or an LTF located near a recreation site could be visually intrusive.

Alternative 1 — No Action

The existing condition of the project area would not be intentionally changed if this alternative were selected. (Refer to description of the existing condition at the beginning of this chapter.) The existing ROS classes and setting indicators would not be changed, nor would existing recreation places and recreation sites. This alternative serves as the baseline for comparing the effects of the other alternatives on recreation.

There are approximately 43,351 acres of National Forest lands in the project area. Of this, approximately 24 percent of the area is classified as P, 30 percent is classified as SPNM, and 46 percent is classified as RM.

Alternative 2

This alternative would construct approximately 20 miles of new roads, and harvest timber only in the eastern half of the project area. Timber would be harvested on the east side of Kitkun Bay, in the Lancaster area, in the area north of Dutch Harbor, and in the Port Johnson area. There would be a 4 percent increase in RM classification, a 7 percent decrease in P, and a 3 percent increase in SPNM.

This alternative proposes timber harvest predominantly in areas which have had prior harvest. The recreation sites in the North Arm of Moira Sound would not be directly effected by this alternative. (Alternative 2 addresses the public comment to maintain the scenic and recreation qualities in this area.) The ROS class of one recreation site would change in this alternative.

Alternative 3

This alternative would construct approximately 50 miles of new roads, and harvest timber predominantly in the eastern half of the project area, plus the area on the northwest shore of the South Arm of Cholmondeley Sound. Timber would be harvested on the east side of Kitkun Bay, in the Lancaster area, on Chasina Point, in the area north of Dutch Harbor, and in the Port Johnson area. A log transfer facility (LTF) would be constructed in the North Arm of Moira Sound, in addition to some harvest units.

There would be a 34 percent increase in RM, a 14 percent decrease in P, and a 20 percent decrease in SPNM. The ROS class of eight recreation sites would change in this alternative. This alternative would also have a visual impact on the marine travel route to six additional recreation sites in Clarno and Aiken Coves, the South Arm of Cholmondeley Sound, as well as the Kegan cabins.

Alternative 4

This alternative would construct approximately 30 miles of new roads, and would harvest timber throughout the project area. Timber would not be harvested on Chasina Point, or in the area north of Dutch Harbor. Harvest activities would be via helicopter on the northwest shore of the South Arm of Cholmondeley Sound, and in the Port Johnson/Moira Sound area.

There would be a 35 percent increase in RM, a 15 percent decrease in P, and a 20 percent decrease in SPNM. The ROS class of two recreation sites would change in this alternative. This alternative would have a visual impact on the marine travel routes to six additional recreation sites, and the Kegan cabins.

Alternative 5

This alternative would construct approximately 45 miles of new roads, and would harvest timber throughout the project area. Timber would not be harvested in the Port Johnson area, or in the North Arm of Moira Sound. There would be a 34 percent increase in RM, a 10 percent decrease in P, and a 24 percent decrease in SPNM.

This alternative proposes timber harvest predominantly in areas which have had prior harvest. The recreation sites in the North Arm of Moira Sound would not be directly effected by this alternative. (Alternative 5 addresses the public comment to maintain the scenic and recreation qualities in this area.) The ROS class of seven recreation sites would change in this alternative.

Alternative 6

This alternative would construct approximately 75 miles of new roads, and harvest all potential units in the project area. There would be a 51 percent increase in RM, a 23 percent decrease in P, and a 28 percent decrease in SPNM. The ROS class of eight recreation sites would change in this alternative. The marine travel route to six additional recreation sites would be visually impacted.

This alternative would have the greatest change to the recreation setting of the project area.

Affected Environment — Wilderness

The National Wilderness Preservation Act of 1964 mandated that:

> *"wilderness areas... shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness."*

The South Prince of Wales Wilderness (SPOW) was established by the Alaska National Interest Lands Conservation Act of 1980. The 91,000 acre Wilderness is located southwest of the Chasina Project Area on the southern tip of Prince of Wales Island. A number of features contribute to the unique character of this Wilderness.

SPOW is remote and isolated, with the nearest community 25 miles away. Access is by boat or float plane, and is typically limited by inclement weather and the hazardous open waters of Dixon Entrance.

The Wilderness is composed of a diversity of landforms. The exposed windswept Barrier Islands are in the southern portion of the Wilderness; the more protected waters of Klakas Inlet are surrounded by scenic mountains in the heart of the Wilderness. Numerous bays and inlets provide protected anchorages to recreationists as well as the local fishing fleet.

Effects of Alternatives — Wilderness

Alternatives 4, 5, and 6 propose harvesting units at the south end of the South Arm of Cholmondeley Sound. These are the closest units to the South Prince of Wales Wilderness; the units are located approximately one mile from the Wilderness Boundary, and are not expected to have an impact on the Wilderness resources.

Affected Environment — Wild and Scenic Rivers

The Wild and Scenic Rivers Act of 1968 provides a means for recognizing and protecting the free-flowing character and the outstandingly remarkable values of selected rivers. Values considered include: scenic, geologic, historic, cultural, ecological, recreation, and fish and wildlife.

There are no rivers in the Chasina Project Area classified as eligible or designated as a federally designated Wild and Scenic River.

Effects of Alternatives — Wild and Scenic Rivers

There are no rivers in the Chasina Project Area classified as eligible or designated as a federally designated Wild and Scenic River.

Affected Environment — Roadless Areas

Roadless Areas are defined as areas in a National Forest or Grassland that meet minimum wilderness criteria, as defined by the 1964 Wilderness Act and its implementing regulations. These are roadless areas that have been identified in the TLMP RSDEIS (1996a) Preferred Alternative planning process and not by the Roadless Area Review and Evaluation II process (RARE II).

The minimum criteria for considering a roadless area in the evaluation of Wilderness potential was established by the Wilderness Act of 1964 and in subsequent regulations and policies. To qualify, an area must contain at least 5,000 acres of undeveloped land which does not contain improved roads maintained for travel by passenger-type vehicles. However, areas less than 5,000 acres may qualify if they are a self-contained ecosystem, such as an island, are contiguous to existing Wilderness, or are ecologically isolated by topography and manageable in a natural condition.

Once an area is roaded, it is generally no longer available for Wilderness consideration. Roadless Areas are described in Appendix C of the TLMP Draft Revision (1991a).

The Chasina Project Area includes the No. 507 Eudora Roadless Area (36,291 project area acres), as identified in the TLMP RSDEIS (1996a).

The Eudora roadless area is located on southeast Prince of Wales Island. It contains rugged mountains in Cholmondeley Sound and a flat to moderate interior. Its western boundary coincides with the South Prince of Wales Wilderness, and its eastern boundary is saltwater. Eudora is typical of Southeast Alaska coastal temperate rain forests.

The east coast has a rich history of prehistoric and historic use by Native cultures. Native corporations have made extensive land selections in the northern part of the Eudora area (see Chapter 3 - Land Adjustments, Uses, and Permits).

There is a wide variety of recreation use in the area, including cabins and trails. In addition, a number of mining claims are in the areas around Green Mountain, Bokan Mountain, Niblack Mountain, and all around Moira Sound.

The many sounds and bays provide bases for commercial fishing. The Big Creek drainage is considered an excellent example of old-growth wildlife habitat. The area remains a significant site for subsistence hunting and fishing.

The visual character of the area is mostly unaltered; however, past and future harvests throughout Cholmondeley sound have had and will have a significant impact on this highly scenic area.

Effects of Alternatives — Roadless Areas

Each alternative proposes a different level of timber harvest and road construction. The following table indicates the total number of roadless acres for each alternative, and Value Comparison Unit (VCU) for each alternative.

Table REC-3
Roadless Acres By Alternative in Chasina Project Area

	VCU							
	6740	6770	6780	6790	6800	6810	6820	
Alt.	W. Arm Cholm.	Dora Bay	S. Arm Cholm.	Kitkun-Chasina Pt.	E. Chasina	Pt. Johnson Dutch Harbor	N. Arm Moira	Total Roadless Acres
1	1,933.57	3,236.96	10,857.85	6,025.47	3,742.93	6,323.85	4,169.87	**36,290.50**
2	1,933.57	3,236.96	10,857.85	4,839.77	2,862.49	3,316.96	3,857.12	**30,904.70**
3	1,198.19	3,236.96	9,618.35	2,757.56	166.81	3,002.00	541.01	**20,520.17**
4	1,367.03	1,576.35	9,556.41	2,238.23	3,560.83	1,254.23	1.10	**19,554.18**
5	1,231.86	1,576.35	9,823.52	254.89	2,318.82	5,188.03	3,463.96	**23,857.43**
6	1,191.05	1,576.35	9,611.53	184.22	166.81	426.33	1.10	**13,157.39**

Scenic Resources

Key Terms

Cumulative Visual Disturbance (CVD)—the sum of all scenic effects created by all landscape alterations that are visible at a given point in time.

Distance Zones:

- **Foreground**—the detailed landscape found within 300 feet to one-half mile from the observer.
- **Middleground**—the space between foreground and background in a picture or landscape. The area located from one-half to 4 miles from the viewer; often the most critical zone for scenery management; form, texture, and color remain dominant, and pattern is important.
- **Background**—the distant part of a landscape; from 4 miles to the horizon from the viewer; line, form and pattern are the dominant visual characteristics.

Visual Quality Objectives (VQOs) (Inventoried)—define different acceptable degrees of alteration of the natural landscape based strictly on aesthetic factors of inherent scenic quality and public sensitivity.

Visual Quality Objectives (VQOs) (Proposed)—the set of visual objectives for specific land areas proposed for the project after consideration of all multiple resource values and objectives. These, if adopted, will provide guidance for the design of future development activities.

- **Preservation VQO**—only ecological changes are allowed. Maintains the natural condition.
- **Retention VQO**—management activities are not visually evident to the casual forest visitor.
- **Partial Retention VQO**—management activities may be evident, but must be subordinate to the natural or natural appearing landscape.
- **Modification VQO**—activities may dominate the natural landscape character, but their design must borrow from the naturally occurring visual elements so completely that the activity resembles to a great degree natural occurrences in the area.
- **Maximum Modification VQO**—activities may clearly dominate the landscape character, but are designed so they appear as natural occurrences from background viewing positions.

Visual Condition—a measure of the degree of human-caused alterations to the natural landscape character. It is usually used to describe existing or expected future conditions, defined in terms that closely correlate with VQOs listed below are the different visual condition levels:

> **Level I-Unaltered**—areas where only ecological changes have taken place. Corresponds to preservation VQO.
> **Level II-Imperceptibly Altered**—areas where changes in landscape are not noticed unless pointed out. Corresponds to retention VQO.
> **Level III-Slightly Altered**—areas in which changes in the landscape are noticed, but do not attract attention. Corresponds to partial retention VQO.
> **Level IV-Moderately Altered**—areas in which changes in the landscape are easily noticed and may attract attention. Corresponds to modification VQO.
> **Level V-Heavily Altered**—areas in which changes in the landscape are strong and obvious to the forest visitor and appear as major disturbances. Corresponds to maximum modification VQO .
> **Level VI-Drastically Altered**—areas in which changes in the landscape are in glaring contrast to the natural forest appearance. This is an unacceptable visual condition. Does not meet minimum visual objective.

Existing Visual Condition—the degree of alterations to the natural landscape condition presently occurring on the ground.
Future Visual Condition - the degree of alterations to the natural landscape condition expected at the end of a proposed planning or harvest period.

Affected Environment

Introduction

An important aspect of Southeast Alaska's natural resource base is its attractive setting. The importance of the scenic splendor of the area is evident by increased tourism and a heightened awareness of and sensitivity to visual resource values by Alaska's residents. The Visual Management System (VMS), developed by the Forest Service in 1976 and revised in 1996, inventories these visual resources and provides measurable standards for their management.

The VMS deals with the management of the visible aspects of the land and the design of human activities which occur upon it. The VMS provides an overall framework for the orderly inventory, analysis, and management of scenery (Landscape Aesthetics: A Handbook for Scenery Management 1996d). The system applies to every acre of National Forest System Lands and all activities administered by the Forest Service.

The VMS is a two-part analytic process. The first part assesses the scenic quality level (Landscape Character and Variety Class) of the project area as found in its natural state. The second part assesses viewer sensitivity levels based on the intensity and type of use of these landscapes.

Two factors, scenic quality (or Variety Class) and viewer sensitivity levels are combined to establish a set of inventoried Visual Quality Objectives (VQOs).

The following discussion applies the VMS to the Chasina Project Area.

Scenic Quality

Landscape Character

Landscape character is an overall visual impression of landscape attributes—the physical appearance of a landscape that gives it an identity and "sense of place." Landscape character gives a geographic area its image.

The Chasina Project Area is part of the Coastal Hills character type. Part of the sale area is characterized by steep-faced blocky ridges with rounded summits up to 2,500 feet (South Arm Cholmondeley Sound) or up to 1,000-1,500 feet (North Arm Moira Sound). Some areas are characterized by relatively rugged peaks with highly dissected slopes and distinctive rock forms (Dora Bay); much of the coast line is characterized by irregular shorelines, a variety of coves, and many island clusters (Lancaster-Kitkun Bay area and head of North Arm Moira Sound and Port Johnson). Other portions are characterized by lower rolling terrain (between Lancaster Cove and Clarence Strait).

Variety Classes

One major part of the sale area is rated as a Variety Class A (i.e., possessing characteristics and diversity unique for the character type to which it belongs). This is the area around Dora Bay extending south to Dora Lake and Eudora Mountain. The area is characterized by dramatic rugged peaks, distinctive cliffs, a great deal of terrain diversity, and an intricate shoreline. This area actually extends south to the Aiken and Clarno Cove area, east of Eudora Mountain, which is just outside the edge of the project boundary. Most of the area though is rated as Variety Class B (i.e., possessing characteristics common to the overall character type).

Sensitivity Level Inventory

The second part of the landscape analysis identifies recreation use areas, communities, travel routes (marine and land), anchorages and cabins, and their associated viewsheds. The visual sensitivity ratings for these areas are based on the type and frequency of use. The ratings range from Sensitivity Level I to Level III.

A Sensitivity Level I is assigned to viewsheds associated with heavily used recreation areas and major marine travel routes. Sensitivity Level II is assigned to areas such as less frequently used boat routes, roads, anchorages, saltwater fishing areas, and their viewsheds. Sensitivity Level III applies to all land areas not seen from any of the Level I or II travel routes or use areas.

Within the Chasina Project Area, most of Cholmondeley Sound is rated a Sensitivity Level II, reflecting the moderate level of boating use the area receives. However, the Sunny Cove area, off the northern edge of Cholmondeley Sound, is rated a Sensitivity Level I due to several summer residences that are located in this bay. This bay is actually outside the project area, but part of its associated viewshed is within the project area. The Kitkun Bay area and the North Arm of Moira sound are rated a Sensitivity Level III.

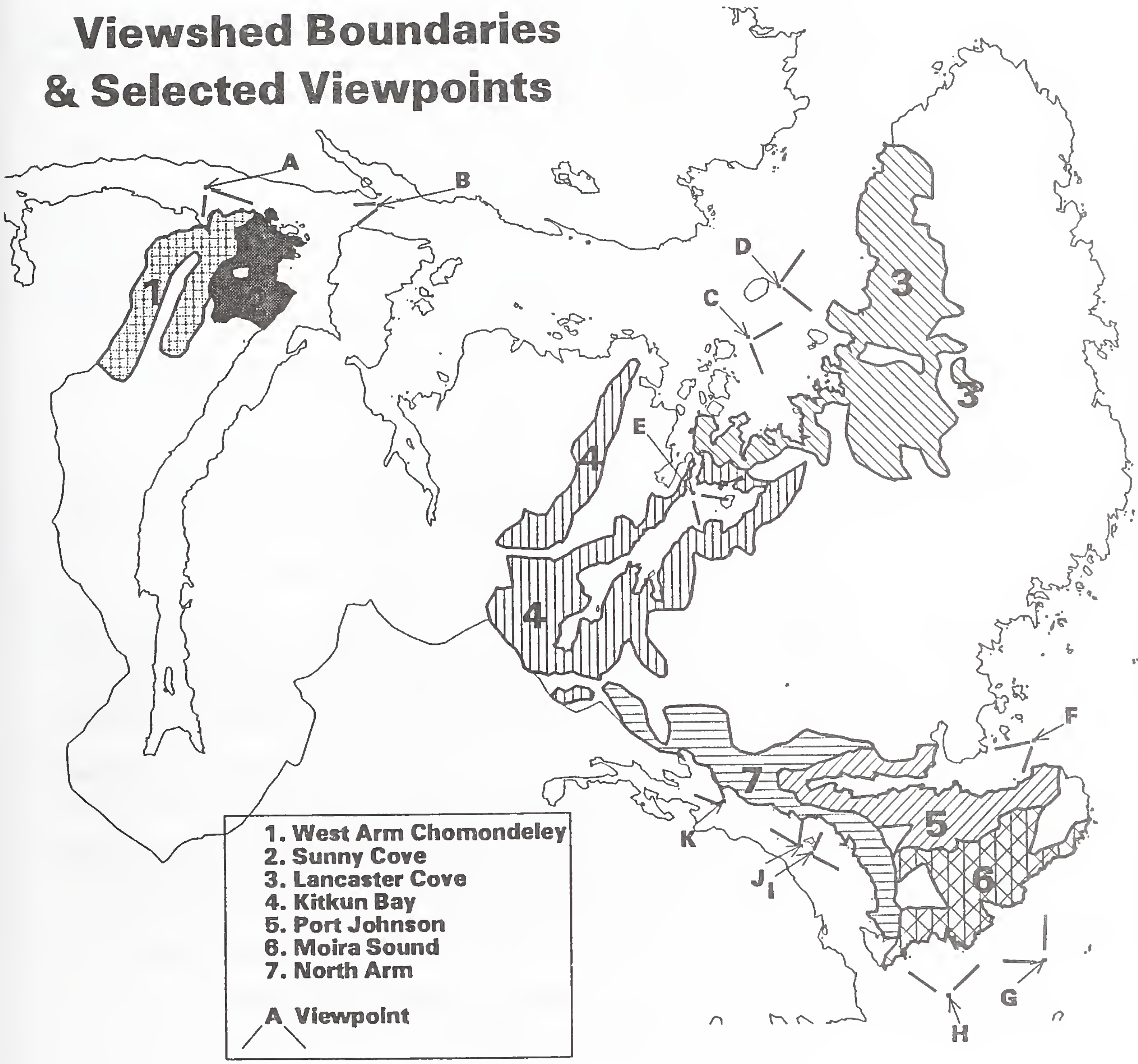
Project Area Viewsheds

For the purposes of assisting in the design of harvest areas and providing a systematic way to analyze and display the impacts of different alternatives, several representative viewpoints within the different bays were identified. Computer perspectives were developed from these viewpoints using the PC New Perspectives software to help design and analyze the different alternatives. The land areas seen from these different viewpoints make up several discrete viewsheds. The alternative effects analysis is based on these viewsheds listed below:

1. Eastern end of West Arm of Cholmondeley
2. Mouth of Sunny Cove
3. Lancaster Cove/Babe Islands
4. Kitkun Bay
5. Port Johnson
6. Moira Sound, between the mouth of North Arm and the mouth of Port Johnson
7. North Arm Moira Sound

In the following sections, these viewsheds will be described in terms of the inventoried visual objectives for these areas, the existing visual condition of these areas, and the visual quality objectives adopted by the Forest Plan Revision—Preferred Alternative. The environmental consequences section will then describe the visual impacts of each alternative on these viewsheds.

Figure SCE-1
Map Showing Location of Viewpoints Used in Analysis and Viewsheds Defined



Visual Quality Objectives (VQOs)

Visual quality objectives are measurable standards for management of National Forest landscapes. Except for preservation, each describes a different degree of alteration of the natural landscape. The degree of alteration is measured in terms of visual contrast with the surrounding natural landscape. See Key Terms for definitions of the different VQOs.

Inventoried Visual Quality Objectives:
Inventoried VQOs are a set of measurable goals for management of scenic resources on National Forest System Lands. They are benchmark guidelines for management direction and are based on the evaluation of landscape variety classes, viewer sensitivity levels, and distance zones (see Key Terms for definitions of foreground, middleground, and background.

Based on the scenery inventory factors described above, the inventoried VQOs for this project area are as follows:

1. All of Cholmondeley Sound (including the eastern end of the West Arm and the Lancaster Cove/Babe Island area)—Partial retention in the foreground and modification in the middleground.

2. Sunny Cove—Retention in the foreground and partial retention in the middleground.

3. Kitkun Bay—Maximum modification; except areas also seen from Cholmondeley Sound are modification.

4. Port Johnson—Maximum modification.

5. Moira Sound, between North Arm and Port Johnson—Partial retention in the foreground and modification in the middleground.

6. North Arm Moira Sound to Aiken Cove—Maximum modification.

Proposed Visual Quality Objectives
The proposed VQOs for the project area, which are consistent with the VQOs in the Preferred Alternative of the Forest Plan Revision Draft, are significantly different from the above inventoried objectives. These differences result from a combination of factors including public input, other resource values and objectives, and the present visual condition of the area.

1. West Arm Cholmondeley Sound—Partial Retention in the foreground and modification in the middleground, except maximum modification where West Arm meets South Arm.

2. Sunny Cove—Partial retention in the foreground around the cove and modification in the middleground surrounding the cove. Rest of the middleground outside the cove is maximum modification. (Most of the viewshed outside the cove is private land.)

3. Lancaster Cove/Babe Islands—Maximum modification throughout the viewshed.

4. Kitkun Bay—Maximum modification in all areas seen from this bay.

5. Port Johnson—Maximum modification.

6. Moira Sound, between North Arm and Port Johnson—Partial retention in the foreground and modification in the middleground.

7. North Arm Moira Sound—Partial retention in the foreground from the central portion of the bay into Clarno and Aiken Cove; modification in the middleground from these locations.

Note: The current Forest Plan (1979 as Amended) has less explicit visual management objectives. However, generally the current plan has slightly higher objectives in the West Arm (allocated to LUD III), and slightly lower objectives in the North Arm of Moira sound (allocated to LUD IV). The rest of the area within Cholmondeley Sound and Port Johnson (allocated LUD IV), has a modification VQO in the foreground and a maximum modification VQO in the rest of the seen areas. These are slightly higher than the objectives in the proposed Forest Plan Revision (allocated to LUD IV).

Existing Visual Condition

The inventory of scenic resources of this area also includes an assessment of the existing condition of its landscapes. See key terms for an explanation of the terms associated with this inventory. This assessment is based on an aerial reconnaissance of the area, a survey of the landscapes from the water, and a review of photos and maps.

As explained in the Key Terms section, these visual condition ratings can be defined in terms that closely correlate with the VQO descriptions. Hence, the Existing Visual Condition inventory can be used to (1) compare a viewshed's actual condition (current degree of alteration) with a project's proposed VQOs, (2) assess cumulative visual impacts of alternatives, and (3) determine whether the proposed management activities or facilities will maintain or change the present conditions, lower the visual quality, or meet/not meet a project's proposed VQOs.

Existing Visual Condition of The Project Area

The following is a summary of the existing visual condition of the project area.

1. Eastern end of West Arm—The National Forest Land seen from this area is in a natural, unaltered condition. However, from some viewpoints the timber harvest on lands managed by Kootznoowoo Native Corporation, in the Divide Head area, clearly dominates the view.

2. Sunny Cove—The foreground and the middleground on either side of the bay are in natural unaltered conditions. However, the viewshed to the south, which is primarily managed by Kootznoowoo Native Corporation, has been drastically altered.

3. Lancaster Cove/Babe Islands—Existing scattered harvest units from a 1990 timber sale on National Forest Lands has created a slightly to moderately altered condition depending on the exact viewing position.

4. Kitkun Bay—Existing harvest from previous timber sales have resulted in a slightly to moderately altered visual condition depending on the viewpoint.

5. Port Johnson—Is predominantly in a natural, unaltered condition on the south side and at the head of the cove (National Forest Land), but is heavily altered on the north side (private land).

6. Moira Sound, between North Arm and Port Johnson—National Forest Lands comprise most of this area and are in a natural, unaltered condition. However, extensive harvest on private lands just to the north of Port Johnson impact the northern edge of this viewshed.

7. North Arm Moira Sound—Almost entirely in a natural, unaltered condition except for the visibility of small portions of one old existing unit near the head of Clarno Cove.

Private Lands

A major factor affecting the visual condition in this project area is the extensive timber harvest on private lands concentrated between the east slopes of the South Arm of Cholmondeley and just beyond the east slopes of Dora Bay. The vast harvest areas in the former case result in a drastically altered visual condition around the South Arm of Cholmondeley Sound and Dora Bay. This harvest dominates the landscape from several viewing positions within the sound, most significantly from portions of Sunny Cove. Another concentrated area of harvest is located on the rolling terrain between Clarence Strait and Cholmondeley Sound. This harvest creates a drastically altered landscape as seen from Clarence Strait, but for the most part, it is not evident from the Cholmondeley Sound side.

Figure SCE-2
Map Displaying Existing Visual Condition of Project Area

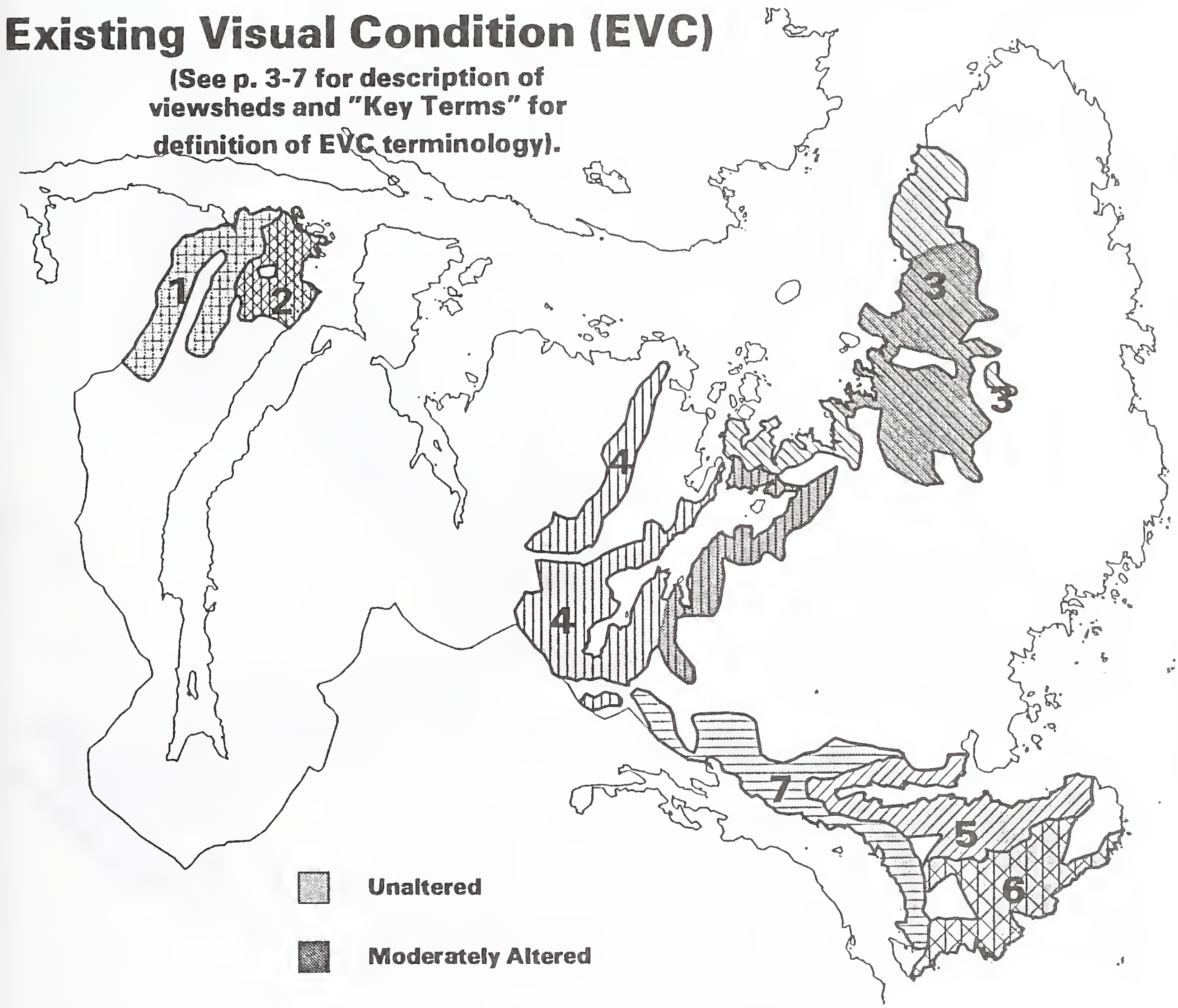
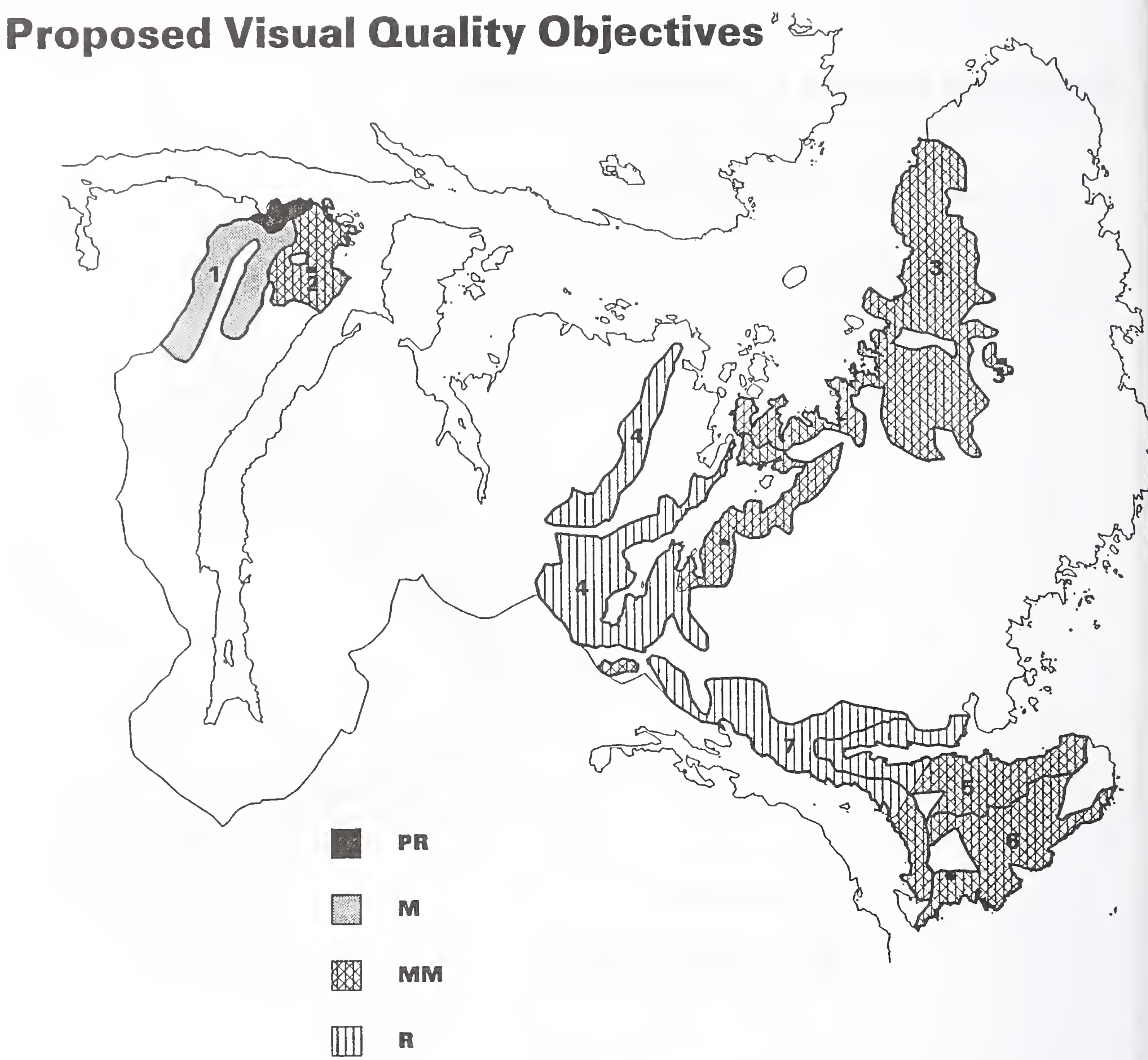


Figure SCE-3
Map Displaying The Proposed or Adopted VQO of Identified Viewsheds



Effects of the Alternatives

The following discussion will describe narratively and graphically the scenery impacts of each alternative on each of the viewsheds identified in the affected environment section. Where applicable, the narrative will describe the cumulative impacts of both past harvest and the planned harvest associated with each alternative. The perspective plots with each viewshed are from the optimum or critical viewing points.

Eastern End of West Arm Cholmondeley Sound

The viewshed potentially impacted in this area is characterized by a 2,000 foot plus blocky ridge with 60 percent and greater slopes. Cannery Creek forms a very prominent, almost V-shaped valley, with very steep slopes that carve into this blocky landform. The harvest proposed in the various alternatives is all located on the east slopes of this valley and on the diverse broken terrain just north and west of Cannery Creek. From this end of the West Arm, the extensive Native harvest on the slopes of Divide Head start to come into view just beyond the Cannery Creek drainage.

Alternatives 1 and 2

No harvest would occur in this viewshed. The unaltered natural condition of the landscape would be maintained.

Alternatives 3 and 4

This alternative does not include any units on the steep, uniform, highly visible slopes above Cannery Creek. All the units are on the more hummocky and diverse terrain just to the east of this drainage. Hence, much of these units are hidden from viewpoints along the West Arm of Cannery Creek. This alternative will closely meet a partial retention VQO, a higher VQO than the modification that is proposed for this viewshed. See Figure SCE-4.

Impacts of LTF East of Cannery Creek

However, in Alternative 3, the proposed A-frame LTF on the shore just east of the mouth of Cannery Creek will clearly dominate the view from the eastern end of the West Arm. The vegetative clearing, rockpit, the likelihood of at least a small exposed rock face, a bulkhead structure extending into the water, and an A-frame structure will combine to create an impact that will meet only a maximum modification VQO. After logging is completed in this area, a partial retention condition could be established in about 15-20 years by re-contouring and re-vegetating the area with conifer seedlings. Alternative r includes no LTF in this area since the units will be logged by helicopter.

Alternatives 5 and 6

These alternatives all incorporate the entire unit pool including three units on the steep slopes above Cannery Creek. Unit 674-23 is visible only from an oblique angle from the water. Unit 678-301 blends well with the terrain and is relatively small. However, Unit 674-265 lies on the very steep slopes above the creek and faces the viewer more directly. In order for this complex of units to meet the modification VQO, Unit 265 should be partial cut either leaving at least 50 percent of the merchantable trees standing or by maintaining several 5-10 acre islands scattered throughout the unit. In addition, the edges of 674-23 should be feathered to soften the hard lines of the unit's boundary. See Figures: SCE-5 and SCE-6.

These alternatives will also include an A-frame LTF east of Cannery Creek. See above for description of impacts.

Figure SCE-4
West Arm Cholmondeley Toward Cannery Creek—Alternatives 3 and 4

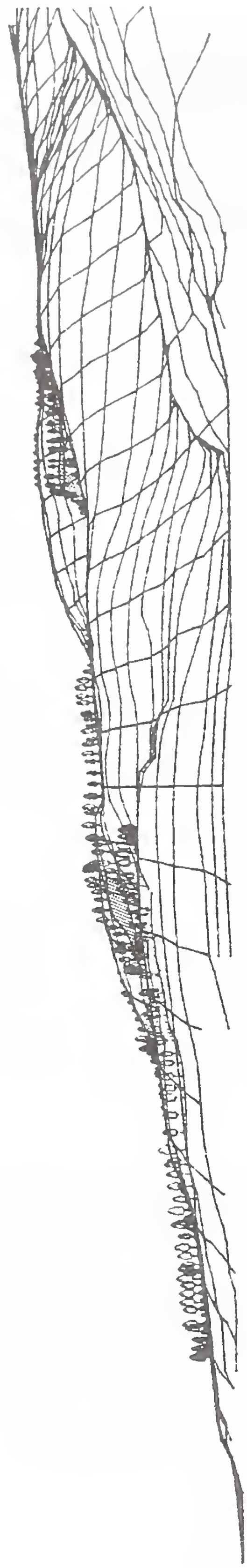


Figure SCE-5
West Arm Cholmondeley Toward Cannery Creek—Alternatives 5 and 6

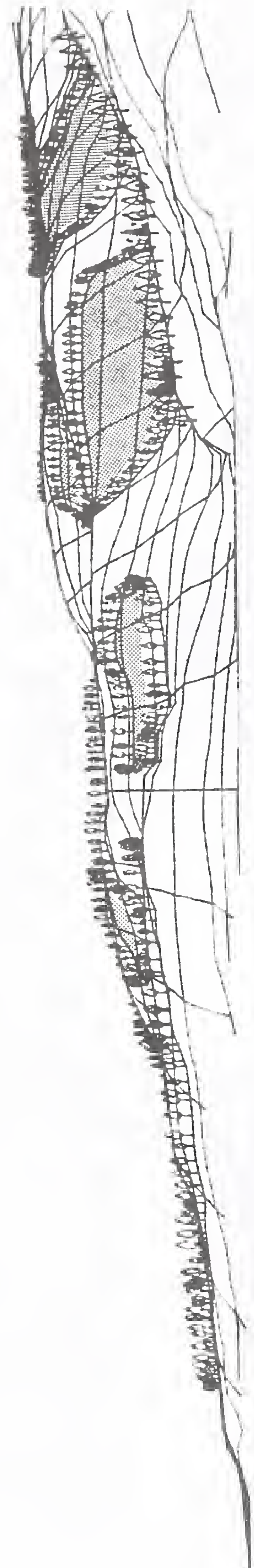
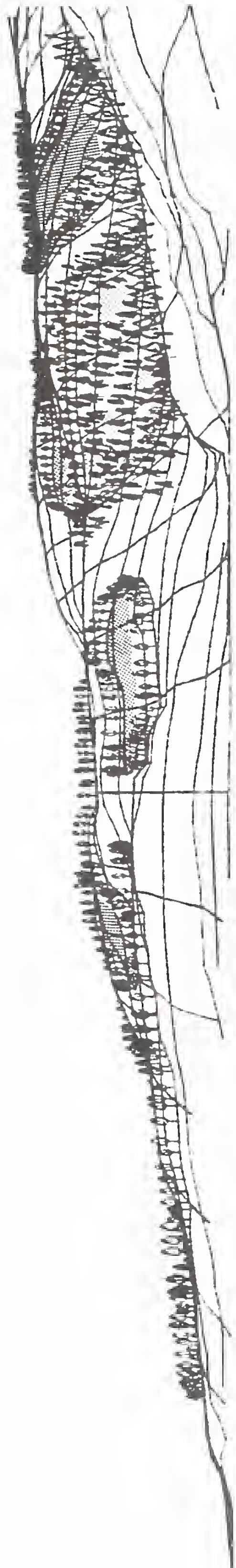


Figure SCE-6
West Arm Cholmondeley Toward Cannery Creek—Alternatives 5 and 6—Mitigated



Mouth of Sunny Cove

This viewshed includes some of the same steep and blocky terrain seen from the West Arm of Cholmondeley Sound. Much of the viewshed from the mouth of this cove includes Kootznoonoo land which has been extensively harvested. This viewshed is in a drastically altered visual condition due entirely to the Native harvest.

Alternative 1 and 2

No harvest is proposed on this ridge in these alternatives. Hence, the National Forest portion of this viewshed will remain in a natural unaltered condition.

Alternatives 3, 4, 5, and 6

The major impact from these alternatives is from a combination of Units 678-316 and 312. From the viewpoints at the mouth of Sunny Cove, these units are in direct alignment with one another. See Figure SCE-7. The other units on this landform are visible only as small slivers. The over-all impact of this harvest will meet the proposed VQO of maximum modification. To meet a modification VQO, which would be consistent with the VQO immediately around the bay, Unit 316 would have to be cut back to about half its size or it would have to be partial cut.

Figure SCE-7
Mouth of Sunny Cove Toward S.W.—Alternatives 3, 4, 5, and 6

Lancaster Cove/Babe Islands

Alternative 1
This alternative will result in the maintaining of the current visual condition. Over the next few decades the existing units will continue to green up and gradually attain some texture and begin to blend into the surrounding landscape.

Alternative 2
This alternative will add a small degree of visible harvest to this viewshed. These visible units (portions of 679-413, 414, 420, 422, 437, and 447) are either small or lay on relatively gentle slopes and/or on slopes obliquely oriented to the viewpoints. Since these units are well dispersed and in scale with the landforms, the combined impact of the existing harvest and the new units will meet a modification VQO, and hence meet a higher objective than proposed in this plan. See Figure SCE-8.

Alternative 3
As with Alternative 2, this alternative adds minimally to the visual impact of timber harvest in the portion of this viewshed south of Lancaster Cove. This alternative includes, for the most part, the same units as Alternative 2 in this area. North of Lancaster Cove the impacts will be greater due primarily to Unit 679-382 which sits on a moderately steep face about one-quarter mile back from the shore. The combined impact of the existing harvest and the new harvest units, particularly no. 382, will still meet the proposed VQO of maximum modification from viewpoints such as just north of Hump Island. See Figure SCE-8.

Alternative 4
This alternative includes the same units as Alternative 3, but also adds a large unit, no. 679-425, on a knob just back from the shore south of Lancaster Cove. This unit will add significantly to the impact from the existing harvest. An additional Unit, 679-409, drapes over a ridge top behind Lancaster Cove and is partially visible. However, the combined impact of existing and planned harvest will meet the VQO of maximum modification. See Figure SCE-9. North of Lancaster Cove, this alternative proposes fewer units than Alternatives 3, 5, and 6, but still includes Unit 679-382. See Figures SCE-11 and SCE-12.

Alternative 5
This alternative includes the same units as Alternative 3 except that it adds Unit 679-409 which drapes over the ridge top behind Lancaster Cove. Unit 679-425 is not included in this alternative. Hence, the impacts of this harvest on the view to the south will meet a modification VQO. See Figure SCE-10. However, because of the highly visible Unit 679-382, the impact on the view to the north of Lancaster will be closer to maximum modification. See Figure SCE-11.

Alternative 6
This alternative includes the same units as Alternative 4 in this area. See Figure SCE-9. However, it adds two more Units, 679-376 and 379, at the north end of this viewshed. See Figure SCE-11. The overall impact of this alternative will meet the proposed maximum modification VQO from viewpoints in Cholmondeley Sound.

Figure SCE-8
Lancaster Cove/Babe Island Toward Lancaster Cove—Alternatives 2 and 3

Figure SCE-9
Lancaster Cove/Babe Island Toward Lancaster Cove—Alternatives 4 and 6

Figure SCE-10
Lancaster Cove/Babe Island Toward Lancaster Cove—Alternative 5

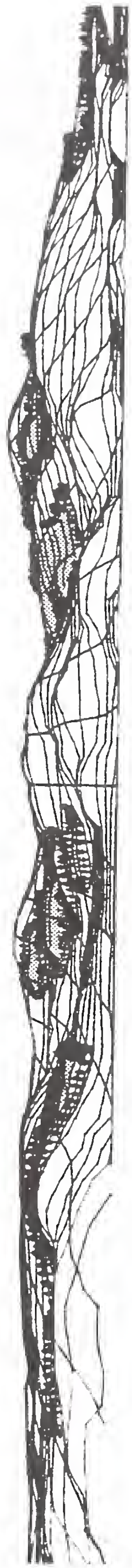


Figure SCE-11
Lancaster Cove/Hump Island Toward North of Lancaster Cove—Alternatives 3, 5, and 6

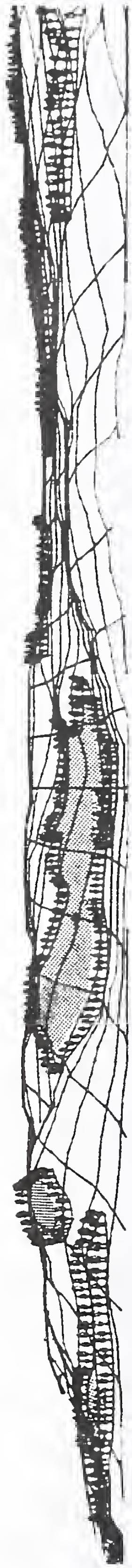
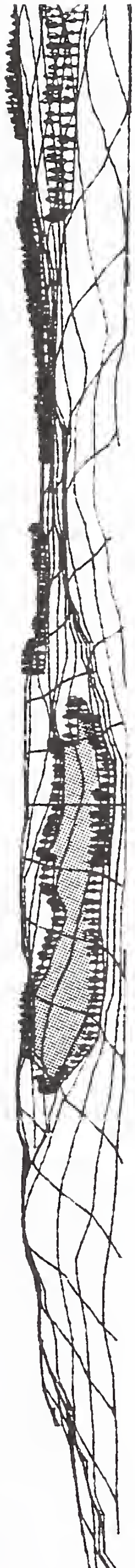


Figure SCE-12
Lancaster Cove/Hump Island Toward North of Lancaster Cove—Alternative 4



Kitkun Bay

The viewshed affected by these alternatives is characterized by a series of blocky 1500-2000 foot ridges and knobs with uniform slopes on the east side of the bay, and a bit more rugged and diverse terrain on the west side of the bay. Past harvest units are scattered around the bay, some on slopes directly facing the water and others on oblique slopes in the valleys between these ridges.

Alternative 1

No harvest is proposed in this alternative. The existing slightly to moderately altered visual condition will evolve to a more natural appearing condition as the existing harvest regenerates and establishes texture that will, over several decades, gradually take on the appearance of the adjacent old-growth stands.

Alternative 2

This alternative adds visual impact to only a part of the east side of the bay with five units located along the side slopes of a drainage. Most of these slopes are either not seen from much of the bay or are obliquely oriented to a few viewpoints. This impact will meet the proposed VQO of maximum modification. See Figure SCE-13.

Alternative 3

This alternative eliminates two of the units at the head of the drainage discussed under Alternative 2, but adds two more Units 679-467/506 and 479 on slopes more directly facing the bay. These two units result in impacts to a few additional viewpoints at the north end of the bay. The overall impact will still meet the proposed VQO of maximum modification. See Figure SCE-14 which displays Unit 679-467/506.

Alternatives 4, 5, and 6

These alternatives include, for the most part, all units in the entire unit pool that are within the Kitkun Bay viewshed. On the east side of the bay this will result in similar impacts to Alternative 3. However, several new units back from the south and southwest shores of this bay will add significant new visual impacts to these presently unaltered portions of this viewshed. The overall impact will still meet the proposed VQO of maximum modification.

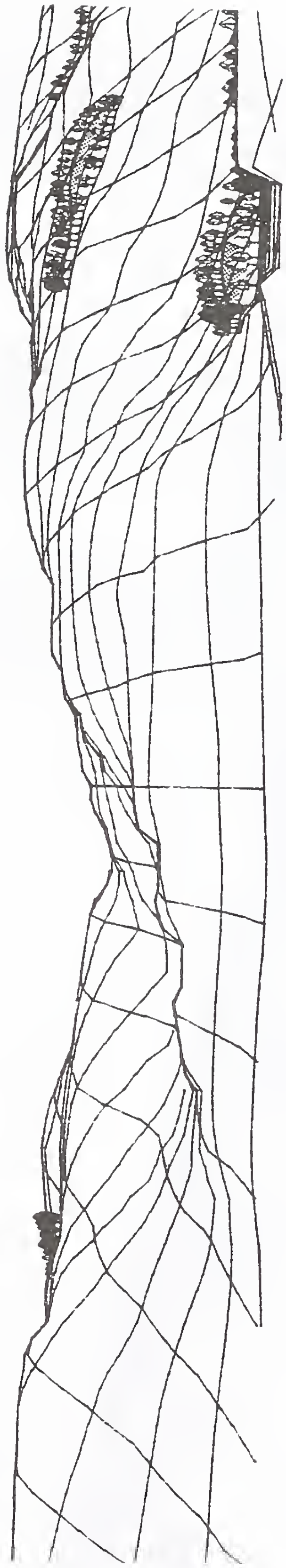


Figure SCE-13
Outlet of Kitkun Bay Looking East—Alternative 2

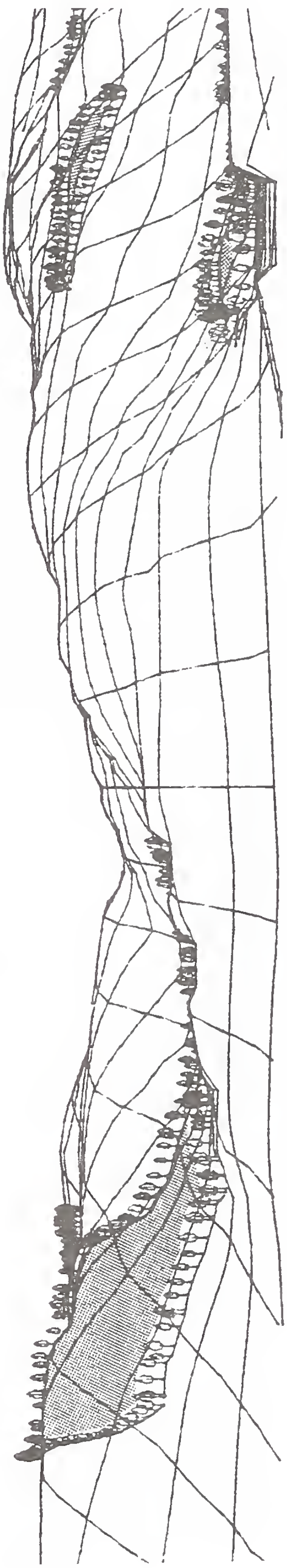


Figure SCE-14
Outlet of Kitkun Bay Looking East—Alternatives 3, 4, and 6

Port Johnson

The viewshed affected by these alternatives is a moderately broken terrain of 1,000-1,500 foot ridges and knobs consisting of moderate and steep slopes and rounded summits. The head of this bay and the south shore are in a natural condition, while the north shore with its gentler slopes have been extensively altered by harvest on private lands.

Alternatives 1 and 5

No harvest is proposed in this viewshed in this alternative. A natural unaltered condition would remain on the south side of the bay.

Alternatives 2, 3, and 6

These alternatives include several units of various sizes spread across the slopes above the south shore of this bay. The major impact is from Unit 681-368 that sits high on the slopes above the bay. Much smaller units, that lay on knolls or gentler slopes, surround this large unit. The overall impact of this harvest will meet the proposed VQO of maximum modification. See Figure SCE-15.

Alternative 4

This alternative includes a smaller number of units on the slopes above the south shore. However, it still includes Unit 681-368. This alternative meets the proposed VQO of maximum modification. See Figure SCE-16. Some alterations to Unit 368, such as leaving a few islands or peninsulas around the edges of the unit, would enable this group of units to meet a modification VQO.

Figure SCE-15
Port Johnson—Alternatives 2, 3, and 6

Figure SCE-16
Port Johnson—Alternative 4

Moira Sound Between Port Johnson and the Entrance to North Arm of Moira Sound

The viewshed affected by these alternatives is characterized by broad, gently rolling landforms. Two broad, rounded knobs sit at either end of this viewshed. Lower, gently sloping to flat terrain connects these two knobs. This viewshed is presently in an unaltered condition.

Alternative 1, 2, and 5

No harvest is proposed in this area in these alternatives. The viewshed will remain in an unaltered condition.

Alternative 3

Six units are scattered throughout this viewshed and are located generally on gently sloping terrain. From most viewing positions this harvest will readily meet the VQO of modification. One Unit, 682-304, which sits partially on the steepest slopes in the viewshed, is too dominant from some viewing positions to meet the modification VQO. See Figure SCE-17. To meet this objective the unit should incorporate some leave islands and peninsulas in the northeast finger of the unit in order to break up the scale of the harvest. See Figure SCE-18.

Alternatives 4 and 6

This alternative adds two more Units, 682-303 and 682-302/307, on different faces of the 800 foot knoll at the southwest corner of this viewshed. Unit 682-303 dominates the view at the entrance to the North Arm of Moira since it encompasses most of the southern face of this knob. As designed now, this alternative does not quite meet the modification VQO because of its apparent scale. See Figure SCE-19. To meet this objective Unit 682-303 should be broken up to some degree by adding some structure to the middle of the unit in the form of a few 5-10 acre leave islands near the top middle of the unit. Unit 682-304 should be mitigated in a manner described under Alternative 3. See Figure SCE-20.

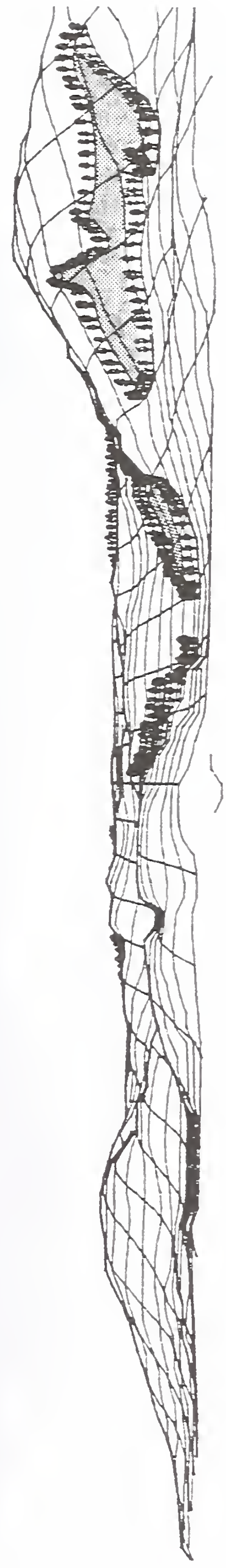


Figure SCE-17
Moira Sound—Alternative 3

Figure SCE-18
Moira Sound—Alternative 3—Mitigated

Figure SCE-19
Outside Entrance to North Arm—Alternatives 4 and 6

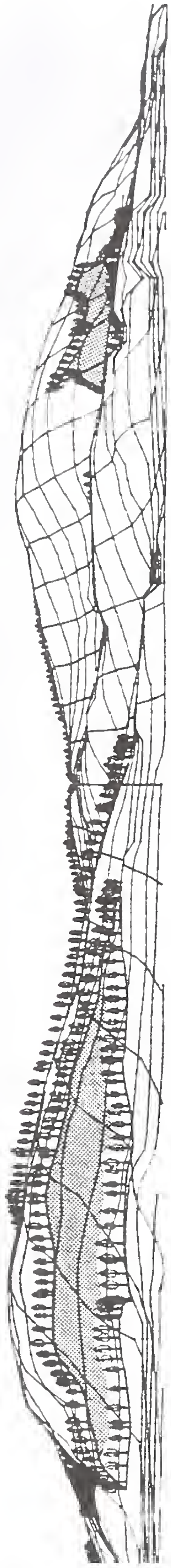
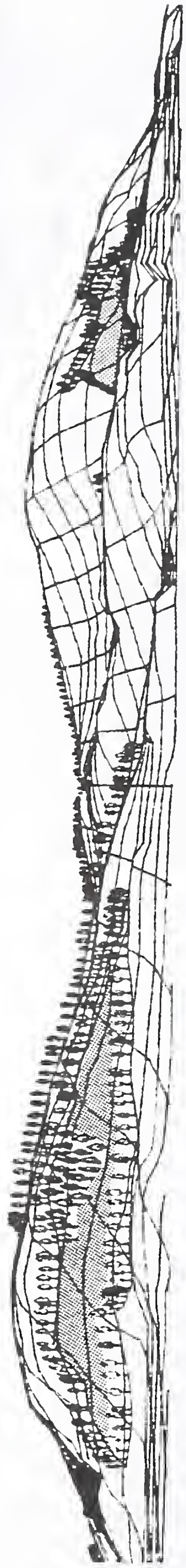


Figure SCE-20
Outside Entrance to North Arm—Alternatives 4 and 6—Mitigated



North Arm - Moira Sound

The viewshed affected by these alternatives is on the north side of this bay and is characterized by a broad, almost flat plateau above the outer half of the bay. Slopes from the top of the plateau to the shore are generally very steep and uniform. Above the inner half of the bay on the north side is a broadly rounded, large, 1,500 foot plus landform. Much of the foreground slopes just above the water are uniform and steep. Above these slopes are some minor benches and some moderately diverse terrain. No major timber harvest has occurred in this landscape except for a few very old, small A-frame units near the head of the bay.

Alternatives 1, 2, and 5

No harvest is proposed in this viewshed in these alternatives. The landscape will remain in a natural, unaltered condition.

Alternative 3

Only Unit 682-301 is visible in this viewshed in this Alternative 3. It sits high on slopes coming off the broad plateau above the outer part of the bay. It is a long unit that extends about half-way down the slope. The unit as planned now has somewhat straight sides and square corners. See Figure SCE-21. To fully meet the proposed VQO of modification, the impact of this unit needs to be mitigated by rounding the upper corners and redirecting the side-boundaries inward toward the upper center of the unit so that they cross the contours at less than a perpendicular angle. An additional mitigation measure would be to leave some 1-2 acre leave islands at each upper corner of the unit and in the middle of the unit. See Figure SCE-22.

The other impact to this viewshed in this alternative is from the proposed new log transfer site located on the north shore of this bay just north of Deichman Island. Because of the view acres of vegetative clearing, the introduction of rock fill along the shore and the construction of a rock ramp out into the water, this facility will dominate the view toward the north shore from the area around Deichman Island. Hence, this facility will probably not meet the proposed VQO of partial retention from the waters around this island. However, from the rest of the inner half of the bay, the facility will not be highly visible and will meet the partial retention objective.

Alternatives 4 and 6

These alternatives add six additional units visible from different portions of North Arm. Two units are particularly critical as far as impacts to this viewshed are concerned. Unit 682-503 sits near the top of a foreground ridge on steep slopes near the middle of the bay. Unit 681-347 sits on a middleground slope almost directly behind Unit 682-503 as seen from the entrance to the bay inward to viewpoints around Deichmann Island. As designed presently, these two units create a major visual impact because of their size, straight sides, and square corners and because from many perspectives they appear to be adjacent to each other. See Figure SCE-23. Unit 503, because of its dominant size and shape, does not meet the proposed VQO of partial retention. Unit 347, primarily because of its design, does not meet the proposed modification VQO for this middleground portion of the viewshed. To meet these VQOs it is recommended that the following mitigation measures be taken:

1. Implement a partial cut for Unit 503. This partial cut should leave at least 60 percent of the stand in groupings of different sizes. See Figure SCE-24. Another option to meet this VQO would be to create several more dispersed openings of 2-5 acres all along this slope.

2. Re-orient the eastern boundary of Unit 347 so it angles more toward the southwest corner of the unit. In addition, maintain some structure along the backline of the unit by leaving a few islands and peninsula's extending off this backline and along the middle of the western boundary. See Figure SCE-24.

3. Unit 681-352, just west of 347, should include some peninsulas and islands along the backline or some feathering to soften the hard edge of this backline. See Figure SCE-24.

In addition to the above described Units, 681-361 (on a low ridge between the head of Port Johnson and the middle of North Arm) and 682-502 (above the entrance to Nowiskay Cove) will meet the VQO of modification as designed.

The sixth unit is 582-500, seen at the head of Nowiskay Cove. This unit encompasses much of a landform. Though the slope it sits on does not entirely face the viewer positions, the apparent scale of the unit is a bit too large to meet the proposed VQO of modification. See Figure SCE-25. To meet this VQO portions of the upper and southeastern boundaries should be partial cut to provide a feathering effect that would soften the upper edges of the unit and reduce its scale. See Figure SCE-26.

Figure SCE-21
North Arm—Center of Bay Looking East—Alternatives 3, 4, and 6

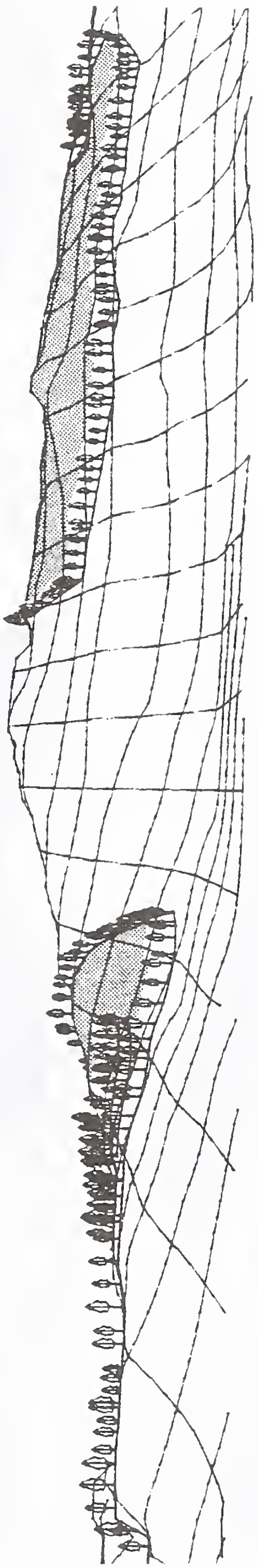
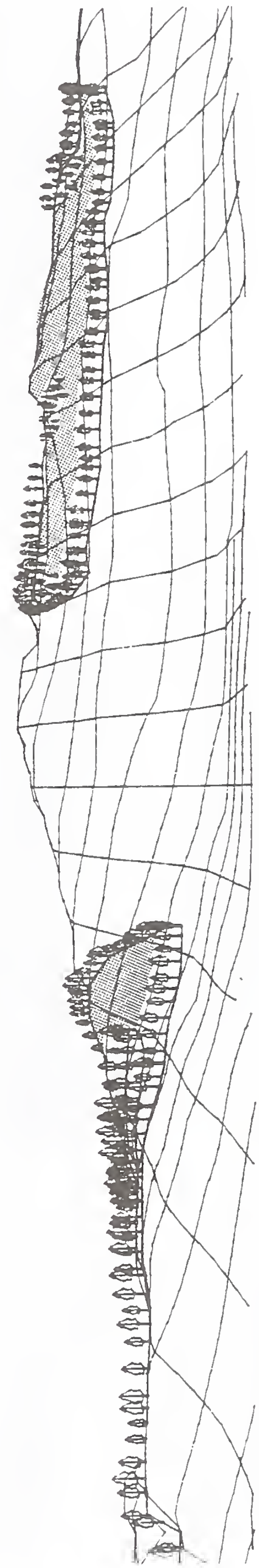


Figure SCE-22
North Arm—Center of Bay Looking East—Alternatives 3, 4, and 6—Mitigated



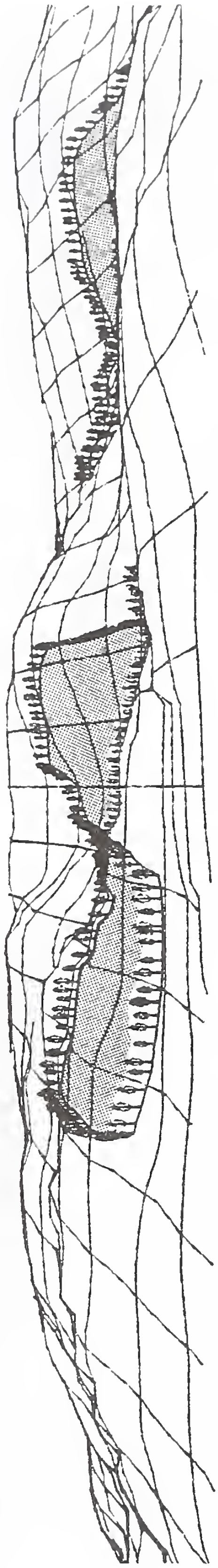


Figure SCE-23
North Arm—Center of Bay Looking NW—Alternatives 4 and 6

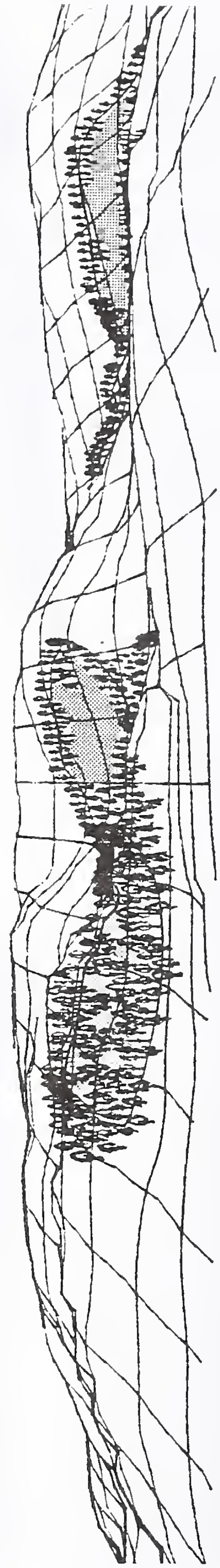


Figure SCE-24
North Arm—Center of Bay Looking NW—Alternatives 4 and 6—Mitigated

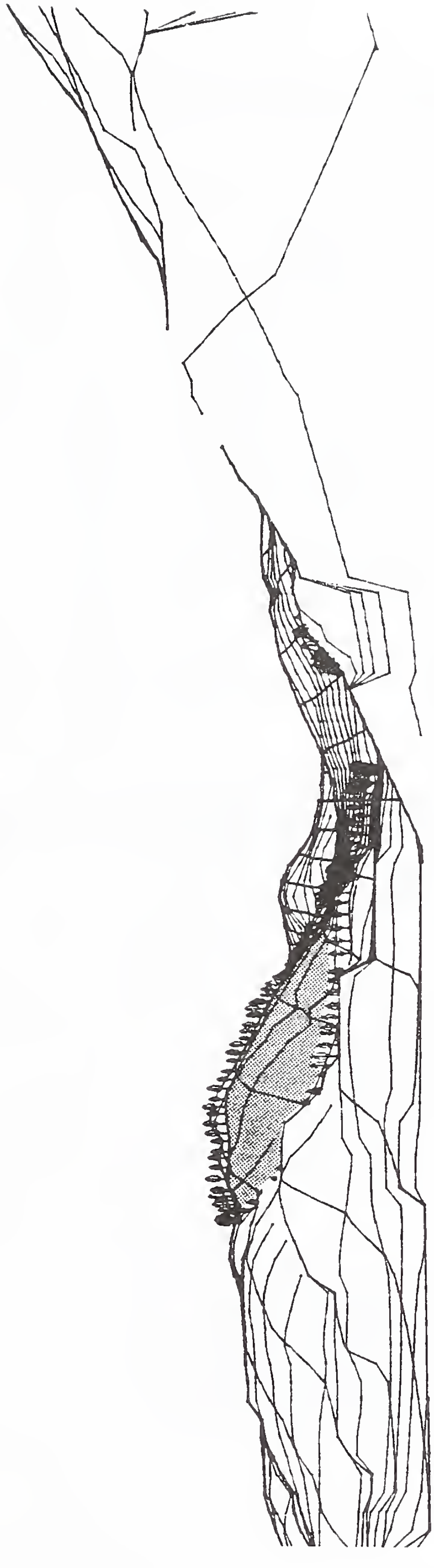


Figure SCE-25
North Arm—Toward Head of Nowiskay Cove—Alternatives 4 and 6

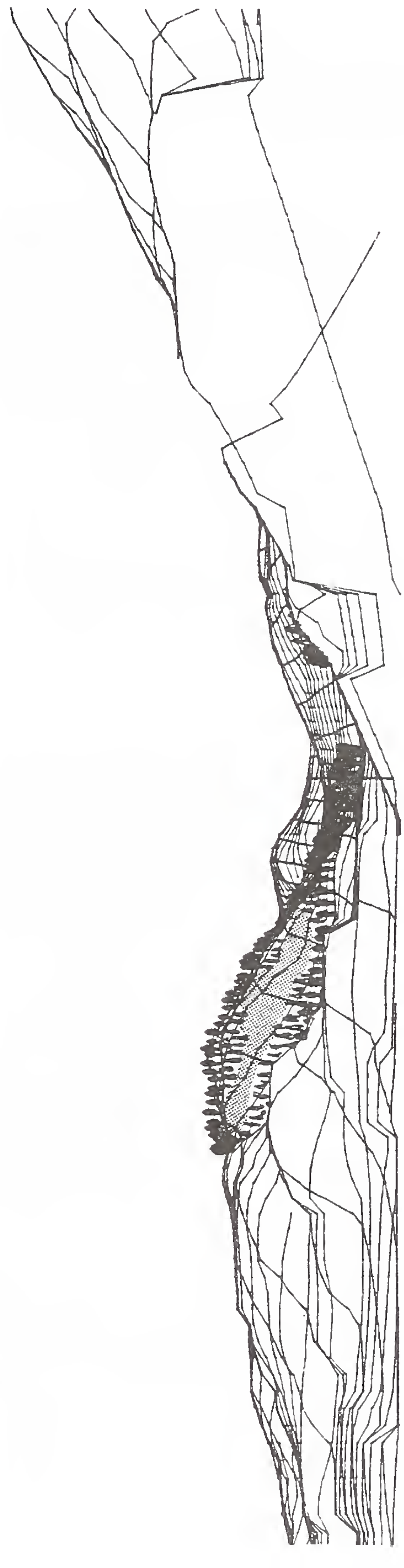


Figure SCE-26
North Arm—Toward Head of Nowiskay Cove—Alternatives 4 and 6—Mitigated

Summary of Impacts of Alternatives

Table SCE-1
Summary of Impacts of Alternatives on Scenic Resources

	Proposed VQO	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
W. Arm Chol. Sound		Exceeds	Exceeds	Exceeds	Meets*	Meets*	Meets*
Sunny Cove		Exceeds	Exceeds	Meets	Meets	Meets	Meets
Lancaster Cove		Exceeds	Exceeds	Meets	Meets	Meets	Meets
Kitkun Bay		Exceeds	Exceeds	Exceeds*	Meets	Meets	Meets
Port Johnson		Exceeds	Meets	Meets	Meets	Exceeds	Meets
Moira Sound		Exceeds	Exceeds	Meets*	Meets*	Meets*	Meets*
North Arm		Exceeds	Exceeds	Exceeds*	Meets*	Exceeds*	Meets*

Exceeds — Proposed harvest results in a visual condition that exceeds the proposed VQO for the viewshed, i.e. meets a higher VQO.
Exceeds* — Though the proposed harvest will meet the VQO in a portion of the viewshed, in the vast majority of the viewshed, the proposed harvest exceeds the VQO.
Meets — Harvest planned in the viewshed meets the proposed VQO.
Meets* — Harvest meets proposed VQO assuming mitigation measures are followed.

Land Adjustments, Uses, and Permits

Key Terms

Alaska Native Claims Settlement Act (ANCSA)—provides for the settlement of certain land claims of Alaska natives.
Encumbrance—a claim, lien, charge, or liability attached to and binding real property.
Native Selection—application by Native corporations to the USDI Bureau of Land Management for conveyance of a portion of lands withdrawn under ANCSA in fulfillment of Native entitlements established under ANCSA.
Special Use Permits—permits and granting of easements (excluding road permits and highway easements) authorizing the occupancy and use of land.
State Selection—application by Alaska Department of Natural Resources to the USDI Bureau of Land Management for conveyance of a portion of the 400,000-acre State entitlement from vacant and unappropriated National Forest System lands in Alaska, under the Alaska Statehood Act.

Affected Environment

Land Status

Prior to 1971, the Tongass National Forest, Ketchikan Area land ownership pattern had not changed significantly, with only minor changes taking place as National Forest System lands were transferred to private home sites, canneries, and townsites. Beginning in the early 1970s, land ownership changes were made as a result of legislation, including the Alaska Native Claims Settlement Act (ANCSA) and the Alaska National Interests Land Conservation Act (ANILCA).

State Selections

The State of Alaska, under the Statehood Act of 1959, is entitled to select up to 400,000 acres from the National Forests in Alaska. As of July, 1991, 57 percent of the entitlement had been conveyed. All of the remaining acres have been selected and are in the process of being conveyed by the Bureau of Land Management. Because the State of Alaska was granted the opportunity to select more lands than they were entitled to receive, some of these lands may become available for National Forest management in the future. The State of Alaska has obtained title to approximately 1,744 acres on Babe Island and in the Kitkun Bay area (VCU 679).

Native Selections

Native selections are authorized under 14(h)(8) of ANCSA. A large portion of the project area has been encumbered because of Kootznoowoo Native Corporation selection. Kootznoowoo Native Corporation has obtained title to approximately 20,199 acres within the Chasina Project Area. Additional acreage has been selected and may be conveyed after completion of surveys to determine actual acreage.

Private Land

In addition to Kootznoowoo Native Corporation lands, there is a 10 acre piece of private property at the old cannery site just west of South Arm.

Special Use Permits

Table LAN-1 summarizes the special use permit that exist in the Chasina Project Area.

Table LAN-1
Summary of Special Use Permit Sites

Name of Permittee	Special Use	Legal Description	Management Area
Kootznoowoo Native Corporation	Shore ties	T78S, R88E, S12	K24
Klukwan Forest Products, Inc.	Shore ties	T77S, R88E, S9	K24
Kootznoowoo Native Corporation	Road Use Permit	T77S, R89E, S19	K24

Mining Claims

An examination of the Bureau of Land Management records revealed 11 private, patented mining claim groups within the Chasina Project Area. These are the Golden Fleece (Mineral Survey (MS) 540, 1581), Valparaiso (MS 766), James (MS 766), Paul Lake (MS 760), Moonshine (MS 789), Jumbo (MS 1058), Amazon (MS 790), Boston (MS 1056), Cape Horn (MS 1055), Stockton Quartz (MS 587), and North Arm Marble (MS 728) (Mass et al., 1995).

There are 40 known mining claims for locatable minerals within the Chasina Project Area that have been relinquished by Sealaska Corporation. However, Sealaska is about to be conveyed the subsurface mineral rights to 1,260 acres in T77S, R88E as part of the Sealaska Subsurface Land Exchange. An additional 1,075 subsurface acres in T77S, R88E and 1,610 acres in T77S, R87E may be conveyed in the future.

Currently the Bureau of Land Management (BLM) mining claim activity reports indicate that there is one mining claim group consisting of 110 claims within the project area. This is the Ruby Tuesday Prospect which is currently under claim by Abacus Minerals Corporation from Vancouver, British Columbia, Canada. These are centered around the Ruby Tuesday and Friendship prospects between South Arm and Cannery Creek.

Effects of the Alternatives

Alternatives 2, 3, 4, 5, and 6 will not directly affect the status of existing special use permits or mining claims, although they may improve access. Alternatives 2, 3, 4, 5, and 6 may require the issuance of new special use permits for camp developments.

Permits and Easements

Alternatives which proposed locating timber harvest units or constructing roads near Kootznoowoo Native Corporation and State ownership boundaries may require updated land line surveys. The Forest Service has an existing road easement to access National Forest System lands in the vicinity of harvest Units 680-330, 680-333, 680-335, 681-304, and 681-308.

Roads and Facilities

Key Terms

Access Management—acquiring rights and developing and maintaining facilities needed by people to get to and move through public lands.
Arterial Roads—roads usually developed and operated for long-term land and resource management purposes and constant service.
Collector Roads—collect traffic from forest local roads; usually connect to a forest arterial road or public highway.
Local Roads—provide access for a specific resource use activity such as a timber sale or recreational site; other minor uses may be served.
Log Transfer Facility (LTF)—a facility that is used for transferring commercially harvested logs to and from a vessel or log raft, or for the formation of a log raft.
Main Trunk Roads—primary roads that are used repeatedly for forest access over long periods of time.
Modular Bridge—a portable bridge constructed of components that can be readily assembled and disassembled for movement from one site to another.
Pre-haul Maintenance—work performed prior to use of a road for timber harvest activities; includes blading, shaping, and brush removal.
Temporary Roads—short-term roads built for limited resource activity or other project needs.
Traffic Service Levels—traffic characteristics and operating conditions that are used in setting road maintenance levels.

Affected Environment

The transportation system in the Cholmondeley Sound/Port Johnson Area consists of small isolated road systems scattered around the areas and located close to the shoreline. These road systems are under the jurisdiction of the federal government or private interests. Roads in the project area are under the jurisdiction of the Forest Service or Kootznoowoo Native Corporation. Timber harvest and related Forest Service management activities are the primary purposes for transportation development. These roads are isolated and do not connect with the greater Prince of Wales road system.

The Chasina Project Area contains no public transportation facilities (state highways, ferry dock, or airports). Currently, the project area has approximately 10.1 miles of open National Forest System roads.

Forest Transportation System

The Forest Transportation System includes three types of roads: arterials, collectors, and locals. Arterial and collector roads are usually maintained for use by passenger vehicles and are usually designed with more emphasis on mobility than local roads. Most local roads are not designed or maintained to accommodate passenger vehicles.

The transportation system on the project area can be broken into three categories: (1) private roads, (2) Forest Service roads, and (3) log transfer facilities (LTFs).

There are approximately 56 miles of roads in the project area. Twenty-one miles are National Forest System roads. Since the roads do not connect to other existing road systems on Prince of Wales Island, they are not maintained for passenger vehicles unless timber harvest operations are active. These single-lane, rough-rock roads are primarily designed for heavy off-highway logging trucks.

Traffic service levels portray the expected traffic characteristics for forest roads in the project area (see Appendix J, Transportation).

Table RF-1 displays the amount of miles of road by traffic service level and by alternative.

Table RF-1
Miles of Road By Traffic Service Level

	Traffic Service Level C		Traffic Service Level D	
Alt.	**Existing**	**Planned**	**Existing**	**Planned**
1	0	0	21.0	0
2	0	0	21.0	12.0
3	0	0	21.0	37.2
4	0	0	21.0	19.4
5	0	0	21.0	33.1
6	0	0	21.0	63.1

Maintenance Levels

Maintenance levels are based on the anticipated use of the roads. Because roads in the project area are isolated, predominantly intermittent resource management use, and off-road vehicular and foot traffic is expected.

Applicable maintenance levels for the project area are as follows:

Maintenance Level 1 (Traffic Service Level D)—Roads are closed by bridge removal, organic encroachment, or other closure methods, and are monitored for resource protection.

Maintenance Level 2 (Traffic Service Level C)—Roads are maintained for high clearance vehicles and monitored for resource protection.

During resource management activities, the roads will be maintained commensurate with that activity. After completion of the management activity, these roads will revert back to the above maintenance levels.

Road Development
Road development patterns are similar from one alternative to another due to the location of the resource being used, terrain characteristics, and development costs. Roads are located to minimize disturbance on the land, yet provide access to resources. Thus, road locations generally follow routes of favorable terrain where practicable.

Construction and Reconstruction of Roads
Three classes of road would be constructed as part of the proposed project, each class having different projected uses and construction standards. Temporary roads were considered local roads for analysis purposes, since these roads are similar to local roads.

Arterial and collector roads are generally mainline roads requiring higher standards and heavier investment to provide prolonged use. These roads can be built to lower standards initially and upgraded as use intensifies. Thus, the logging operator may construct arterial and collector roads to low or medium standards depending on use.

Forest roads are designed to varying standards depending on use.

Local roads are generally single purpose roads resulting in lower design standards and usually cost less than arterial and collector roads.

Road reconstruction consists of complete roadbed repairs, major culvert or bridge replacement, roadbed realignment, and/or resurfacing. All haul maintenance consists of ditch cleaning, roadside brush removal, roadbed surface blading, and installation of minor pipes.

Construction and Reconstruction of Major Drainage Structures
Since the late 1960s, timber harvest activities have occurred in the project area. On both new and existing roads, modular bridges and permanent culverts will be used.

In situations where temporary roads cross Class III streams, temporary log stringer bridges may be used and removed upon completion of use. Temporary log stringer bridges may also be used on specified roads during road construction, prior to installation of the permanent structure, to facilitate timing and scheduling concerns.

Rock Quarry Disposition Locations
Generally, rock borrow quarries are located every 1 to 2 miles along roads. The quarry location is determined by quality rock sources, haul distances, development costs, frequency of entry, and visual resource considerations. An allowance for rock quarries is included in the acres shown for right-of-way (ROW) clearing.

Some rock quarries are small, one-time uses, while others are expanded during future road building operations if quality rock is available.

Rock quarries with expansion potential will be retained for expansion, particularly in situations where potential roads and timber harvest may be developed in the future, or where numerous roads radiate out from a point near a centralized quarry. Rock quarries near the ends of the road system will be closed and reclaimed by spreading stockpiled overburden on the floor of the quarry.

Each quarry will be evaluated for disposition during the construction stage. Each quarry will be evaluated for the following: (1) availability of additional quality rock, (2) feasibility of expansion, and (3) future rock resource needs in the area.

Log Transfer Facilities (LTFs)

The transportation of harvested timber in the Cholmondeley Area requires that the log bundles be removed from the log trucks, placed in the water, and rafted to the sort yard at Thorne Bay and to the Ward Cove mill. Due to the isolated nature of the project area, this transportation will require the use of log transfer facilities (LTFs). LTF consolidation, by connecting to existing sites, is to be considered where feasible to minimize impacts to beach and marine zones. Consolidation would avoid the need to build LTFs on encumbered or state selected lands. Further analysis of LTFs is discussed in the Marine Environment and Log Transfer Facilities section of this chapter.

Effects of the Alternatives

The effects of the transportation system on other resources are considered in the sections relating to those resources (soil, water, visuals, fisheries, marine environment, etc.). This section focuses on the effects of each alternative on the transportation system, and will be grouped into the following categories: (1) construction costs, (2) road development, and (3) access management.

Table RF-2 displays the transportation development costs by alternative.

Table RF-2
Transportation Development Costs (in MM$) by Alternative

	Alternative					
	1	**2**	**3**	**4**	**5**	**6**
New Construction Miles	0	12.0	37.2	19.4	33.1	63.1
Total Construction $	0	2.0	6.8	3.3	5.8	11.0
Reconstruction Miles	0	7.7	10.7	11.6	11.6	11.6
Total Reconstruction $	0	0.1	0.1	0.1	0.1	0.1
Bridge Const./Reconstruction	0	1	0	1	1	1
Total Bridge Cost $	0	0.04	0	0.04	0.04	0.04
LTF Construction/Reconstruction						
North Arm Moira LTF	0	0	.15	0	0	0
W. Arm Cholmondeley LTF	0	0	0.25	0	0.25	0.25
Total LTF Construction $	0	0	0.40	0	0.25	0.25
Existing LTF						
Lancaster Cove	0	0.01	0.01	0.01	0.01	0.01
Total Construction and Reconstruction Cost	0	**2.15**	**7.31**	**3.45**	**6.20**	**11.40**

Road Development

The position and spatial arrangement of resource areas and the amount of harvesting that would occur in new undeveloped areas requires changes in the road system. Proposed new roads are needed to harvest the timber volume associated with each alternative. A total of 191 miles of road would eventually be needed to harvest all commercial forest lands in the project area. The total planned roads are the roads needed to harvest the remaining timber volume in the rotation. Road development includes expansion of the current road system in all action alternatives.

Table RF-3
Total Transportation Systems (Miles)

Alternative	Total Existing Roads	Existing Roads Used	Proposed Roads
2	21.0	12.4	12.0
3	21.0	17.3	37.2
4	21.0	20.3	19.4
5	21.0	20.3	33.1
6	21.0	20.3	63.1

Discrepancies may be found between tables due to rounding

Expansion of the road system requires: (1) construction of varying classes of roads (arterial, collector, and local), (2) reconstruction of some existing roads, (3) construction and reconstruction of varying types of major drainage structures, and (4) construction coordination activities with other resource needs.

Construction and Reconstruction of Roads

The development of collector roads occurs in all action alternatives. Alternatives 3 and 6 develop the most miles and highest costs, while Alternative 2 develops the least miles (12) and the lowest costs. The level of local road development is not directly proportional to the level of harvest in each alternative, because of differing spatial arrangements of harvest units between alternatives.

The miles and cost of roads to be developed are shown by road class in Tables RF-4 and RF-5. Table RF-6 displays the miles of new road and major drainage structure costs.

Table RF-4
Existing Roads Proposed for Use

	Alternative					
Road Class	**1**	**2**	**3**	**4**	**5**	**6**
Collector Miles	0	4.66	9.58	10.86	10.86	10.87
Local Miles*	0	12.34	11.78	15.65	8.72	15.76
Total	0	**16.90**	**21.36**	**26.51**	**19.58**	**26.63**

* Includes local roads on private lands.

Table RF-5
Proposed Roads

	Alternative					
Road Class	**1**	**2**	**3**	**4**	**5**	**6**
Collector Miles	0	0	4.8	5.77	9.83	11.62
Local Miles	0	12.0	32.45	13.61	23.29	51.51*
Total	0	**12.0**	**37.25**	**19.38**	**33.12**	**63.13**

* Discrepancies between tables are due to rounding.

Table RF-6
New Road And Major Drainage Structure Costs

Alternative	Miles	Cost (Million $)
1	0.0	0
2	12.0	.04
3	37.25	0
4	19.38	.14
5	33.12	.14
6	63.13	.14

Reconstruction

Reconstruction of existing roads is associated with all action alternatives. Activities range from major realignment and bridge replacement to minor blading and shaping of the existing road from proposed harvest units to the existing and new LTFs.

Table RF-7 displays the miles and cost of heavy reconstruction for all alternatives. Pre-haul maintenance is not displayed as it is assumed all roads require some minor surface blading, ditch cleaning, and brushing prior to commencement of log hauling operations.

Table RF-7
Road Reconstruction

Alternative	Miles	Cost (Thous. $)
1	0	0
2	7.7	76.8
3	10.7	106.5
4	11.6	115.8
5	11.6	115.8
6	11.6	115.8

Road Connections to Eliminate LTF Sites

If road connections between LTF tributary areas are feasible and practical, LTF sites can be eliminated. It is feasible to connect proposed Port Johnson to the existing LTF at Lancaster Cove.

Connection of the road from the Port Johnson area to the Lancaster Cove road system would eliminate the need for the North Arm Moira LTF. The road connection would construct a 2.8 mile section of road, providing access to additional resources for future management activities. The road connection and the construction of the LTF at North Arm Moira are considered in Alternatives 3 and 6. The cost difference between the two options is approximately $140,000; the road connection costing more than construction of the LTF and associated roads. Construction of the tie road is recommended due to the relatively small difference in cost compared to the benefits of access to additional future resources, administrative access during management activities and post sale management, and a decrease in impacts on the marine environment by eliminating a LTF.

Road connections to LTFs on private lands were considered, but not analyzed in depth due to the high cost of road connections and/or the cost of upgrading the sites to current standards and obtaining permits.

Helicopter options to eliminate LTFs are discussed in the Silviculture and Timber section of this chapter.

Construction Coordination with Fish and Wildlife

Construction Near Eagle Nest Trees

Road construction is not anticipated to be within 330 feet of any inventoried eagle nest trees in the project area.

In accordance with an agreement between the U.S. Forest Service and the U.S. Fish and Wildlife Service, specific criteria concerning road construction within one-half mile of an active eagle's nest is implemented to mitigate disturbance to eagles. There are new roads and reconstruction planned within the one-half mile zone of known eagle nests on the project area. Nest locations are listed in the Wildlife Section of Chapter 2—Mitigation.

Construction Near Streams

Road construction requires numerous stream crossings. Many of the streams are habitat for various fish species. It is necessary to minimize impacts on these streams to protect salmon fry and eggs. Maintaining fish passage characteristics and scheduling construction activities (fish timing) around fish movements are methods used in mitigating impacts of roads on streams.

Some stream crossings have been identified as needing fish timing restrictions for construction of structures, to minimize impacts on fish eggs and fry. Generally, these restrictions can be accommodated through planning and scheduling of the construction activities. In many cases, additional costs would be incurred to accommodate the timing restrictions. Such costs would include additional equipment mobilization and demobilization, increased construction actions for mitigation, and increased construction delays. The number of crossings, the acres of buffers affected by road crossings, and the number of crossings with fish timing and/or passage restrictions are displayed in Table RF-8 and RF-9. It is estimated that approximately

250 feet of road is involved in crossing a Class I and II stream and buffer with 200 feet for the buffer crossing and 50 feet for the stream channel crossing. Class III crossing miles and acres are not shown.

Table RF-8
Number of Proposed RP Stream Crossings

RP Crossing	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Class I	0	10	17	5	12	24
Class II	0	2	18	5	12	19
Class III	0	19	72	36	74	108
Total Crossings	**0**	**27**	**107**	**46**	**98**	**151**

Table RF-9
RP Stream Crossings by Number of Crossings and Miles and Acres Affected*

Alternative	No. of Crossings	Miles	Acres
2	12	0.57	4.13
3	35	1.66	11.90
4	10	0.47	3.40
5	24	1.14	8.26
6	43	2.04	14.62

* Road clearing width is estimated to be an average of 75' wide including rock pits.

The fish timing and passage crossings for the project area are displayed in Table RF-10.

Table RF-10
Number of Crossings with Fish Timing and/or Passage Restrictions

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Timing and Passage	0	12	22	12	22	37
Timing	0	4	15	11	20	34

Road Construction Within TTRA and RP Prescription Zones

Roads will be located within stream zones where it is the environmentally preferred choice and where it is consistent with safety regulations. When these roads are designated on the ground, care will be taken to keep as much of the road as possible outside TTRA and RP Prescription Zones. In most cases, the limiting factor will be the type of terrain adjacent to the various stream zones which will govern how much of a given road segment can be located outside these zones.

Some road development inside the TTRA and RP Prescription Zones is unavoidable. For example, roads accessing LTFs will require location in beach and, in some cases, estuarine zones.

Tables RF-12 through RF-13 display the planned and existing miles and acres of roads in the TTRA and RP Prescription Zones. The existing mileage shown in Tables RF-12 through RF-13 includes only the existing miles of road used in the alternatives. There are additional existing roads in the project area that are not proposed in the alternatives. For a discussion of stream buffers, see Chapter 2, Mitigation Measures.

Table RF-11
Road Development in Stream Zones

	Existing Roads Used		Planned	
Alternative	Miles	Acres	Miles	Acres
1	0	0	0	0
2	0.55	3.74	0.57	4.13
3	0.80	5.44	1.66	11.90
4	0.85	6.12	0.47	3.40
5	0.80	5.44	1.14	8.26
6	0.85	6.12	2.04	14.62

Table RF-12 displays the existing and proposed road development affecting the TTRA Lake Zones.

Table RF-12
TTRA Lake Zones Affected by Roads

Alternative	Existing Roads Used Miles	Existing Roads Used Acres	Planned Miles	Planned Acres
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0.5	3.0

Table RF-13 shows the existing and proposed road development affecting the RP Lake Prescription Zones.

Table RF-13
RP Lake Prescription Zones Affected by Roads

Alternative	Existing Roads Used Miles	Existing Roads Used Acres	Planned Miles	Planned Acres
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0.5	3.0

Note: Includes both no-cut and partial cut zones

Table RF-14 displays the existing and planned roads affecting the Estuarine Zones development (1,000 feet).

Table RF-14
Estuarine Zones Affected by Roads

Alternative	Existing Roads Used Miles	Existing Roads Used Acres	Planned Miles	Planned Acres
1	0	0	0	0
2	3.00	21.8	0.1	0.70
3	3.75	27.3	1.6	11.60
4	3.75	27.3	1.5	10.9
5	3.75	27.3	1.7	12.4
6	3.75	27.3	3.3	24.0

Table RF-15 portrays the existing and planned road development affecting the Beach Zones (500 feet).

Table RF-15
Beach Zones Affected by Roads

Alternative	Existing Roads Used Miles	Existing Roads Used Acres	Planned Miles	Planned Acres
1	0	0	0	0
2	1.50	10.9	0	0
3	2.25	16.36	0.9	6.5
4	2.25	16.36	1.0	7.3
5	2.25	16.36	1.25	9.10
6	2.25	16.36	2.0	14.50

Table RF-16 shows the existing and planned road development affecting the RP Stream Prescription (no-cut) Zones (100 feet).

Table RF-16
RP Stream Prescription (No Cut) Zones Affected by Roads

Alternative	Existing Roads Used Miles	Existing Roads Used Acres	Planned Miles	Planned Acres
2	0.55	3.74	0.57	4.13
3	0.80	5.44	1.66	11.90
4	0.85	6.12	0.47	3.40
5	0.80	5.44	1.14	8.26
6	0.85	6.12	2.04	14.62

Table RF-17 portrays the existing and planned road development affecting the RP Stream Prescription (Partial-Cut) Zones.

Table RF-17
RP Stream Prescription (Partial Cut) Buffer Zones Affected by Roads

Alternative	Existing Roads Used Miles	Existing Roads Used Acres	Planned Miles	Planned Acres
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0

Proposed Activities on State Land Selections
No road or LTF development will take place within State lands.

Access Management

In all the proposed action alternatives, access to the road system is by boat or float plane. Due to these limits, vehicular use is expected to be negligible except for some use of off-highway vehicles. Administrative activities include salvage and harvest post sale silvicultural activities.

Road Disposition

Roads are closed for numerous reasons including fish and wildlife protection, public safety, and inadequate maintenance funding. It may be necessary to close roads or portions of roads to use by specific vehicle types. Roads under Forest Service jurisdiction can be closed by authority of CFR 36, ch.11, parts 212.7 and 261. Road closure orders will be posted at the Craig Ranger District office.

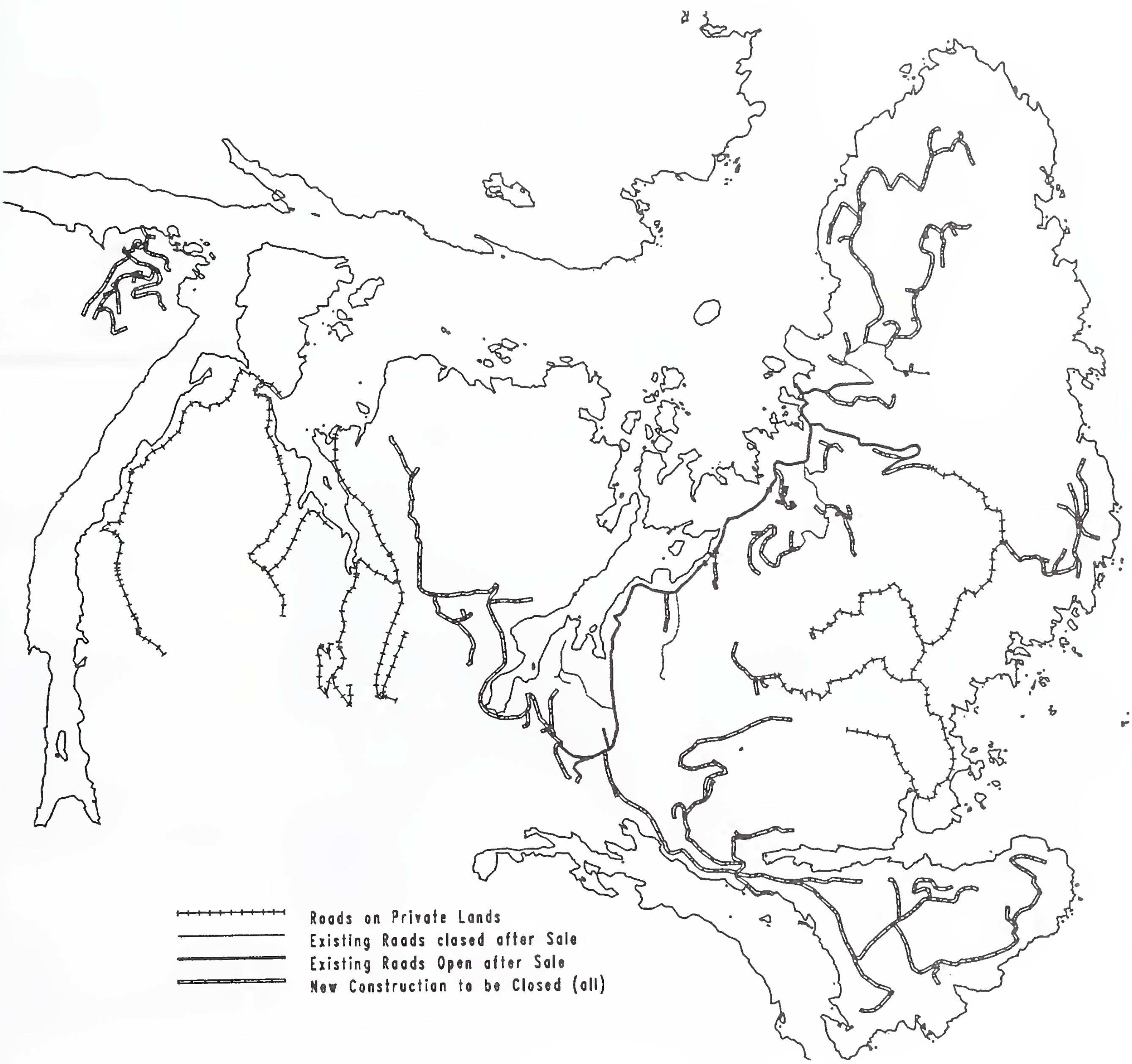
Some main trunk roads will be kept open to meet long-term objectives. Most secondary roads will be closed and seeded to retard alder growth. Maintenance of these will consist of monitoring road and drainage structures for functional and environmental condition. Permanent drainage structures will be installed to meet long-term access objectives; however, maintenance levels fluctuate in response to changing uses. During periods of limited use, maintenance standards are sufficient to provide only for public safety and resource protection. The remaining local roads, except those with bridges, will be left open. The bridges will be removed and used in other locations. The local roads being left open will not be maintained for vehicular traffic, however, drainage structures will be monitored for functional condition. In general, these roads will grow closed organically resulting in closure to vehicular traffic. Maintenance Level 1 will be applied to these roads.

Temporary roads will not be retained on the permanent transportation system. These roads will be closed by removing structures, restoring streambank grade, constructing water bars, and revegetating in accordance with NFMA. When structures are removed, stream banks shall be restored to the natural contours of the original stream banks. All disturbed areas and the entire road prism will be seeded with the appropriate grass seed mixture.

Figure RF-1 illustrates the roads in the project area to remain open with limited maintenance and the roads to be closed. The Summary of Road Management Objectives, containing the specific disposition of all existing and proposed roads, is in Appendix J.

After construction of roads for harvesting timber, the Forest Service may close roads for protection of other resources and/or for economic reasons. The Forest Service does not harvest all available timber that the roads access, as other land owners usually opt to do, so road closure according to ACMP definition has an adverse effect on streams and other resources when multiple entries are required. Roads proposed to be closed, by the Forest Service definition, are to be considered "inactive" by ACMP definition. All roads will be monitored and maintained, if necessary, after completion of each sale.

Figure RF-1
Roads Open and Scheduled for Closure



Marine Environment, Log Transfer Sites, and Related Facilities

Key Terms

A-Frame LTF—log transfer facility system which consists of a stationary mast with a falling boom for lifting logs from trucks to water. This system is generally located on a shot rock embankment with a vertical bulkhead to access deep water, accommodating operations at all tidal periods.
Low-angle ramp LTF—log transfer facility system which consists of a drive-down slide ramp with slide rails for pushing log bundles into the water.
Log Transfer Facility (LTF)—a facility that is used for transferring commercially harvested logs to and from a vessel or log raft, or the formation of a log raft.
Marine Benthic Habitat—the area occupied by the aggregate of organisms living at or on the bottom of a water body.

Affected Environment

Marine Environment

Southeast Alaska's coastline consists of approximately 30,000 miles of tidal shoreline, roughly 60 percent of the total Alaskan coast. Within this region occurs a great diversity of habitats that collectively account for the complexity of Southeast Alaska's estuary and tidal environments.

The marine environment encompasses a wide variety of ecosystems. The intertidal and subtidal marine environments are subject to effects from log transfer and storage facilities; these are points of concentrated activity associated with the marine transportation of logs. The preferred sites for log transfer facilities (LTFs), log storage areas, camp settlements, and anchorages are in deep bays or along straits or channels. These areas are preferred because the deeper water and stronger currents flush out bark and debris that may enter the water resulting in less effects on marine life. Other marine areas are not addressed here because they are not expected to be affected by activities associated with the timber harvest of this project. Activities outside the areas of concentration are widely dispersed. Any potential effects would be short term and/or diluted below detectable thresholds.

The shallow marine waters and associated mud flats and estuaries found in the protected coves and bays provide habitat for some important species such as Dungeness crab and juvenile salmon. They are part of a complex and dynamic ecosystem that includes shrimp, flatfish, marine worms, echinoderms, sponges, sea anemones, shellfish, plankton, marine algae, and other organisms.

Log Transfer Facilities (LTFs)

The transportation of harvested timber on the project area requires that the logs must be trucked or flown to the ocean, transferred to the water or barges at a LTF and towed to a sort yard for sorting. They are then moved to processing sites like the pulp mill at Ward Cove or the sawmill at Metlakatla.

There are existing LTF sites on private lands within the project area. These sites were considered for use, but not analyzed in detail due to the amount of new construction required to tie the project road system to the private road system, and/or the cost of upgrading the private facilities to meet current environmental standards.

There is one existing Forest Service LTF permitted within the project area that was constructed in 1987. This LTF has been modified to meet the current State and Federal permit requirements.

Figure MAR-1 and Table MAR-1 display the locations of existing and proposed LTFs in the project area.

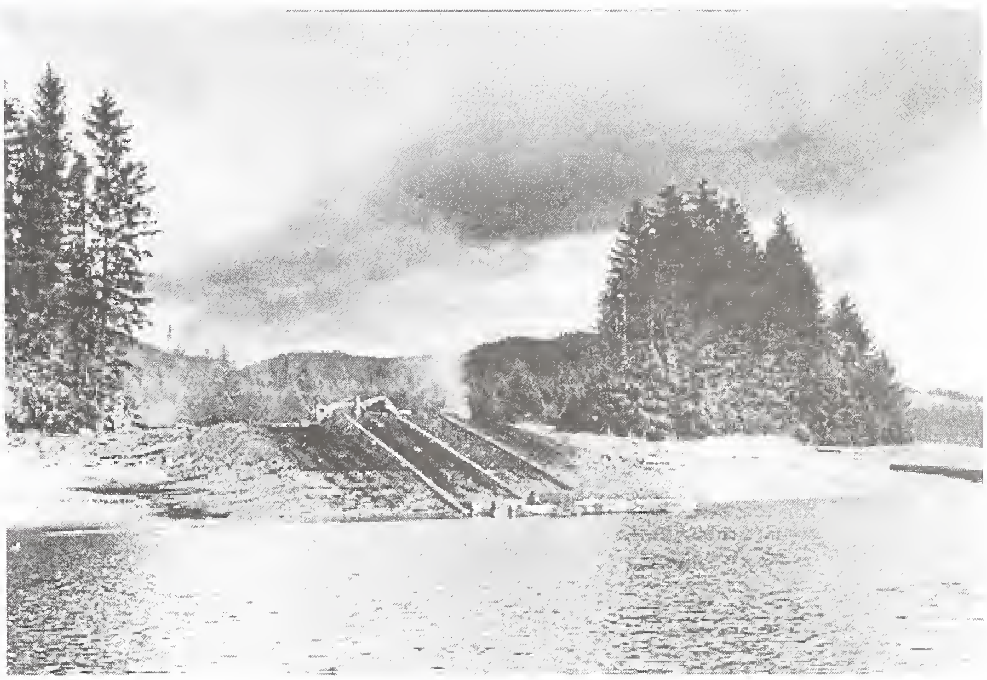


Figure MAR-1
Existing and Proposed LTFs for Each Alternative

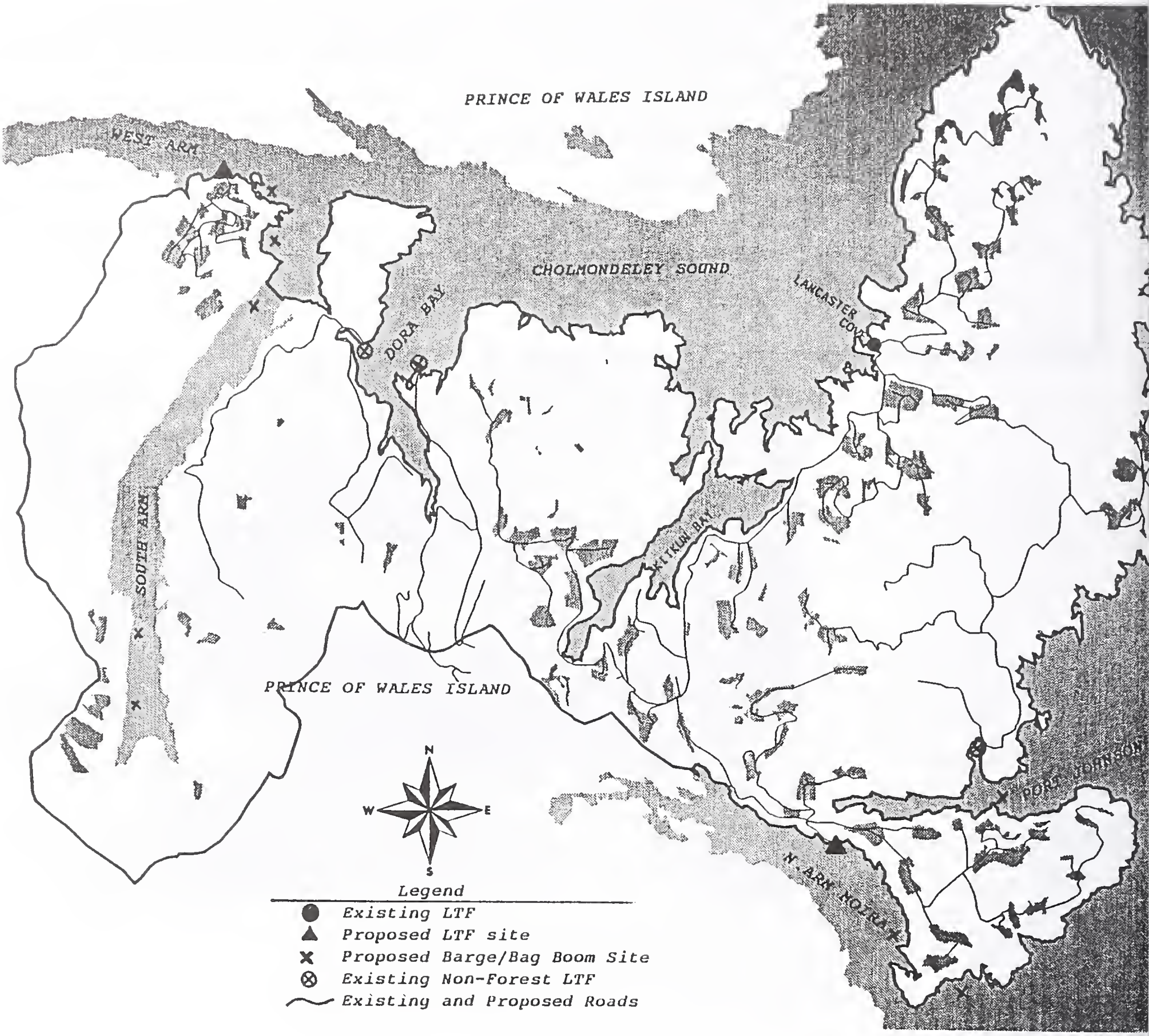


Table MAR-1
Existing and Potential LTF Locations

Location	Site #	Latitude	Longitude
Lancaster Cove	1	55° 05' 45" N	132° 05' 45" W
N. Arm Moira	4N	55° 07' 45" N	132° 05' 45" W
S. Arm Cholmondeley		55° 14' 45" N	132° 18' 45" W

Log Transfer Methods

Four log transfer methods are considered in this analysis. These are: (1) low-angle ramp with rafting facilities; (2) A-Frame type entry device with rafting facilities; (3) a dry land to barge transfer facility; and (4) helicopter placement of logs directly into the ocean or onto a barge.

The Low-Angle Ramp method consists of a shot-rock ramp sloped at 10 to 20 percent grade with wood or steel rails on the ramp surface. Log bundles are walked down the ramp into the water by use of a rubber-tired log loader.

The A-frame method generally consists of a stationary mast with a falling boom for lifting logs from trucks to water. This system is generally located on a shot rock embankment with a vertical bulkhead to access deep water, accommodating operations at all tidal periods.

A modified version of this method uses a stationary A-frame boom with sloping guide rails placed on the bulkhead to guide the logs to deep water at lower tidal levels. Both A-frame systems allow controlled entry of logs into the water.

The Land-to-Barge transfer system requires a deep water bulkhead for a barge mooring facility. Drafts of up to 25 feet are required for barge operations. Logs are loaded directly onto the barge by use of a loader. Barges can also be loaded with logs floating in the water by use of onboard cranes.

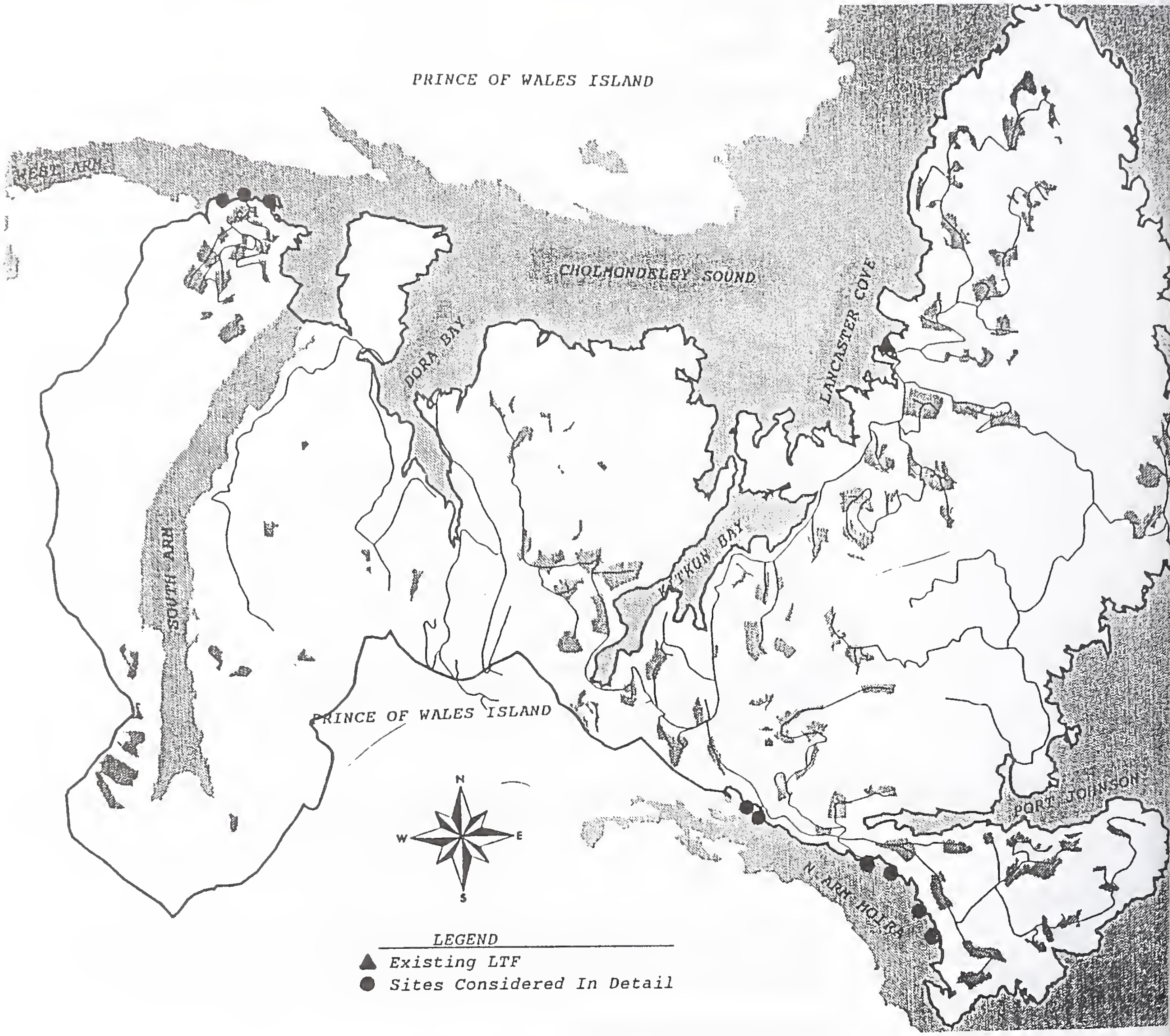
The helicopter transfer of logs to water transportation modes consists of moving logs from the harvest area directly to the water. The logs are placed in a containment area (bag boom), then moved by boom boat to the raft or sort yard. A modification of this system is to fly logs directly to a barge.

Each LTF requires a log transfer area, a small airplane and boat dock, an equipment off-loading ramp, and a log raft storage area. These facilities are generally located within close proximity of the LTF to reduce costs and retain impacts within a localized area.

Sites Considered in Detail

There were nine sites considered in detail; others were eliminated for terrain or environmental reasons.

Figure MAR-2
Sites Considered in Detail



Lancaster Cove is an existing, permitted barge loading facility that would access timber from the Lancaster Cove-Chasina Point and Port Johnson areas. This site has been impacted by past timber harvest activities, both on the uplands and in the marine environment. This site was considered biologically acceptable by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service as an A-frame lift-off system when originally considered for an LTF. Prior to construction of the LTF, the permit was changed to a barge loading facility. Use of the LTF as a barge loading facility is planned for this project. This site meets the Alaska Timber Task Force Siting Guidelines for LTFs.

North Arm Moira (site no. 4N) is a proposed site that would access timber from the Port Johnson-North Arm Moira area. The site was considered biologically acceptable by the U.S. Fish and Wildlife service and the National Marine Fisheries Service. The North Arm Moira site would be developed as a low angle ramp. This site meets the Alaska Timber Task Force Guidelines and may be within a forested wetland.

West Arm, Cholmondeley Sound is a proposed site that would access timber from the east side of Cannery Creek in the West Arm of Cholmondeley. The site is considered biologically acceptable by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. This site would be developed as an A-frame lift-off system. The site meets the Alaska Timber Task Force Siting Guidelines for LTFs.

Logging Camps

The Chasina Project Area has suitable upland areas for land camps, and includes several protected bays and coves suitable for float camps.

Float Camps

Some historical and new float camp sites are expected to be used during implementation of this project. The number and locations of the sites will depend upon the number of logging and road construction contractors engaged in implementing the project. Additionally, camp configuration and type, such as barge or log floats will influence the location. The operator will be required to obtain required state permits for camps.

Land Camps

Some previously used land-based camp sites, and potentially some new sites, are expected to be used in implementation of this project. As with float camps, camp configuration will influence the location.

The contractor/operator will be responsible for obtaining appropriate permits for camps.

Solid waste disposal will not be allowed on National Forest land.

The contractor/operator will be required to submit plans to the Forest Service for handling of any hazardous wastes associated with the operations, including shop areas, land camps, landings, fueling areas, etc.

Effects of the Alternatives

Log Transfer Facilities

The number of LTFs needed to harvest the timber scheduled in all action alternatives varies. Table MAR-2 displays the LTFs required for each alternative.

Table MAR-2
LTFs Required for the Alternatives

LTFs Required	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Existing Sites	1	1	1	1	1
Proposed Sites	0	2	0	1	1
Total	**1**	**3**	**1**	**2**	**2**

Effects on Types of LTFs

LTFs can be either low-angle ramps or bulkhead type structures used for transferring logs from trucks to saltwater. Appendix E has a thorough evaluation of proposed LTFs in accordance with the Alaska Timber Task Force guidelines and in accordance with section 404(b)(1) of the Clean Water Act.

Two general types of facilities and their associated effects on the environment are analyzed. The first type of LTF is a low-angle ramp. This facility varies in direct impact to the intertidal area with rock riprap and fill from 0.05 acres to 0.5 acres.

The second type of facility considered in this analysis is a bulkhead facility with a lift-off system. The lift-off system may be either a single or double A-frame. The type of facility ranges in direct impact to the intertidal area with bulkhead construction and fill from 0.1 acres to 0.25 acres. Barge LTFs are considered a bulkhead type facility. Barge LTFs generally require a longer, slightly wider rock embankment area at the seaward end of the bulkhead, thus requiring filling in a larger intertidal area. Barge LTFs do not require a rafting area.

Of the two designs, the ramp design is approximately one-third the cost to construct, maintain, and operate. Maintenance of a timbered bulkhead facility would require replacement at 10-year intervals, thereby substantially increasing the costs of future harvests (Faris and Vaughan 1985). Concrete bulkheads can be substituted for timbered bulkhead structures, also at a higher cost. Table MAR-3 displays the construction and reconstruction costs associated with each LTF.

Another form of log transfer from land to water oriented transportation is aerial transport of logs from the harvest area directly to water or a barge. This method eliminates the need for truck haul and road development. However, this system is economically prohibitive except in specific situations.

Table MAR-3
LTF Construction/Reconstruction Costs

	Transfer Method	Transfer Equipment Cost	Site Development Cost	Total Cost
Site Construction:				
North Arm Moira	Ramp	0	150,000	**150,000**
West Arm Cholmondeley	A-frame	250,000*	250,000	**250,000**
Reconstruction:				
Lancaster Cove	Barge	0	10,000	**10,000**

* Equipment costs not used in analysis.

Effects of LTFs on the Marine Benthic Habitat

During the transfer of logs from land to water, bark is sloughed off and may be deposited on the ocean bottom; bark also is sloughed off by agitation by wind and waves while the logs are in rafts. If the bark accumulates on the bottom, it can diminish habitat for bottom-dwelling crustaceans and molluscs, as well as hamper underwater vegetation used as food and rearing sites for marine fish and other organisms. All LTFs in the project area have been designed to maximize flushing suspended bark away from the LTF area to the open sea before it can accumulate on the bottom. In 1985, it was determined that discharge of bark into the water at an LTF required a National Pollution Discharge Elimination System (NPDES) permit.

New LTFs are sited in accordance with the Alaska Timber Task Force Siting Guidelines and section 404(B)(1) of the Clean Water Act to mitigate the effects of LTFs on other resources and ecosystems. The existing LTFs generally meet the above State guidelines. LTFs will affect the marine benthic habitat (plants and animals that live in and on the bottom). Marine benthic habitat impacts are expected to be as follows:

Structural Embankment: estimated 0.23 acres affected per site
Site Bark Deposition: 1.0 acre zone of deposition per site
Raft Storage Bark Deposition: unknown

The marine benthic environment impacts are displayed in Table MAR-4.

Table MAR-4
Marine Benthic Impacts by Alternatives

Category	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Existing Number of Sites	1	1	1	1	1	1
Proposed Number of Sites	0	0	2	0	1	1
Acres Effected by Structural Embankment						
Total Number of Sites	**1**	**1**	**3**	**1**	**2**	**2**
Existing	.23	.23	.23	.23	.23	.23
Proposed	0	0	.46	0	.23	.23
Total	**.23**	**.23**	**.69**	**.23**	**.46**	**.46**
Estimated Acres Effected by Bark						
Existing	1.0	1.0	1.0	1.0	1.0	1.0
Proposed	0	0	2.0	0	1.0	1.0
Total	**1.0**	**1.0**	**3.0**	**1.0**	**2.0**	**2.0**

Structural Embankment

All LTF types occupy approximately the same amount of bottom area. For instance, the ramp off-push in a 10 percent grade system extends approximately 250 feet out into the water on a moderately sloped beach. This system is thus long and narrow. The ramp and A-frame systems use more shoreline and do not protrude out into the water as much as the float off-push in system. All systems cover about the same bottom area but in different configurations.

Site Bark Deposition

Two publications describe some of the general effects of LTFs and log storage on the marine benthic habitat. Sedell and Duval (1985) summarize the information available on the effects log transport and storage have on marine resources and fisheries. Faris and Vaughn (1985) examined log transportation and log storage in Southeast Alaska.

Shultz and Berg (1976) examined 32 existing LTF sites and found that 19 had bark accumulation, 8 had no bark accumulation, and 5 had traces of bark. The extent of bark accumulation ranged from 0 to 9.0 acres for 31 of the 32 sites. The 32nd site had accumulation of 182 acres that could not solely be attributed to log transfer activities. Faris and Vaughn (1985) reexamined the original data from Shultz and Berg (1976) and found that

the average accumulation size was 1.96 acres for all sites excluding the 182-acre site. They speculate that bark and debris accumulation may be decreasing over time due to currents. No estimate was made on the length of time before bark accumulation was completely eliminated.

Faris and Vaughn (1985) also examined the extent of total damage to the marine benthic habitat in Southeast Alaska. Their results indicate that from the 90 currently permitted sites, a total of 176 acres would be affected (using the 1.96 acre average). This is .02 percent of the total estuarine area that is less than 60 feet deep. Moreover, when they examined all of the potential area of bark and debris accumulation from all permitted and proposed sites in Southeast Alaska, including all sites considered in the KPC Long-term Sale 1989-1994 EIS, they found that a total of 317 acres would be affected. This is 0.09 percent of the total estuarine area that is less than 60 feet deep in all of Southeast Alaska. This result corresponds with the conclusions of Sedell and Duval (1985) that the evidence of damage on important marine populations (bivalves, crabs and salmonids) was inconclusive because of the small area of impact due to log transfer facilities. This evidence resulted in development of the current siting guidelines (e.g., avoiding crab habitat, shallow areas at the heads of bay, etc.) and suggests that impacts would be minimal.

The major effect of bark and debris accumulation is that little neck clams and bay mussels have been shown to be eliminated when as little as 4 to 5 inches of bark accumulates (Freese and O'Clair 1987). Further, Colin and Ellis (1979) reported molluscs and several polychaetes were excluded by bark debris thicker than 2.5 cm., and that effects of bark may last several decades. From this evidence, it can be assumed that other plants and animals that live in and on the bottom would probably be at similar risk.

Concentrations of chemical leachates from bark have been shown to be toxic to salmon fry, crabs, and clams (O'Clair 1983). However, these toxic substances can settle in saltwater; therefore, these substances do not appear to be a major problem in open water where good circulation exists (Sedell and Duval 1985). The Alaska Timber Task Force Siting Guidelines for LTFs (Appendix E) attempts to mitigate the potential effects of bark dispersal and toxicity by: (1) locating LTFs in areas having the least productive inter-tidal and sub-tidal zones; (2) avoiding sensitive habitats; (3) avoiding shallow water; and (4) providing that LTFs should be located along or adjacent to straits, channels, or deep bays where currents are strong enough to disperse sunken or floating wood debris. Currently, all active LTFs receive a yearly underwater diving and sampling transect as required by the Environmental Protection Agency.

Certain dissolved substances (hydrogen sulfide and ammonia) recently have been shown to occur in open spaces between pieces of bark accumulated on the bottom (O'Clair and Freese 1988). O'Clair and Freese also note that it is not clear whether other toxic substances not measured in the study occur within bark accumulations. These substances do not enter the water above the bark. However, if Dungeness crabs burrow into the bark deposit, it has been demonstrated that their reproductive ability, eating habits, and overall survival can be affected. It should be noted that this type of effect has been demonstrated in only one bark accumulation field (Rowan Bay LTF) and that, in general, Dungeness crabs were not found in bark accumulations at a number of other LTF locations. It is not known whether these effects would occur for other burrowing crab species. Since king crabs do not burrow, it is not clear whether this species is affected by bark and debris accumulation at LTF sites.

Raft Storage Bark Deposition

The other potential effects associated with LTFs are from log rafts and log storage in saltwater. The area under a log raft may be affected by bark accumulations with effects similar to but not as concentrated as those discussed for LTFs. In addition, if the raft is stored in a bay or cove for a long period of time, marine algae may be affected by shading. Occasionally, rafts stored in shallow depths may ground on the bottom. This would cause mechanical disruption or compaction of inter- and subtidal bottom habitats. This would be a short-duration effect because recolonization would begin shortly after the raft refloated, unless the site was repeatedly used and log rafts frequently grounded. Proposed and existing log storage areas in the project area are deep enough and are not expected to ground.

Barge LTFs

Barge LTFs probably would have less effect on the marine environment than rafting LTFs, although no studies are available for comparison. The rock embankment associated with the facility would be longer and slightly wider at the seaward end. The additional length and width would eliminate a larger intertidal area than a rafting LTF breakwater. The longer length and wider seaward end in deeper water would require dredging and filling in the subtidal area Bark and debris would accumulate only in a small area around the extreme seaward end of the facility.

Helicopter to Log Boom or Barge LTF

Helicopter to log boom or barge LTF would probably have less effect on the marine environment. Helicopter to log boom would be more impacting than to a barge. However, the log boom can be located in deep water to avoid bark deposition and embankment in the higher value shallow areas. Helicopter to barge would eliminate bark deposition and embankment in the marine environment.

Fisheries

The effects of LTFs on fisheries resources have not been quantified. It is unlikely that any effects on returning adult fish would occur unless a LTF to raft storage area was immediately adjacent to an anadromous fish stream and caused blockage of entry into the stream. Juvenile pink and chum salmon that spend several months, immediately after out-migration, in protected bays and coves would be more likely to be affected by activities in the marine environment. These small fish are highly mobile as they actively feed on marine invertebrates. Some of their preferred food items live on the surface of the bottom. Bark accumulation and the area under the embankment of a standard breakwater eliminates a small portion of the habitat of those food items but is unlikely to cause measurable adverse consequences.

It has been hypothesized that the breakwater usually associated with a LTF structure, regardless of whether a raft or barge, can cause greater mortality of pink and chum juveniles because they are forced to move into deeper water where more predators consume them. It is not known whether this is a major source of mortality in addition to the naturally low survival rate attributed to early marine life stage of juvenile pink and chum salmon. Because barge LTFs require longer breakwaters, the probability of this effect may be increased.

There is no formal documentation that LTF structures or activities associated with their use, conflict with commercial fishing near the facility. If a facility were located in a small bay or

cove, it is possible that there could be some difficulty maneuvering around log rafts or moored barges to get to favored fishing sites. No adverse consequences on commercial fishing, subsistence uses, or marine resources are anticipated as the result of LTF location.

Camps associated with a LTF site can cause additional use of fisheries and marine sources. There is no data currently available on the amount of additional use occurring at various camp locations in the study area. The competition for resources at or near logging camp locations would probably increase. There is currently little or no information to indicate that resource allocation problems have occurred as the result of a logging camp. The Board of Fisheries and Game can control the amount of harvest by setting bag limits, shortening season lengths, or by instituting a complete closure of a fishery. If resource problems arise because of increased resource pressure due to a logging camp, the Forest Service would aid the Alaska Department of Fish and Game in attempting to resolve the problem.

Wildlife

From a wildlife perspective, there are two types of effects associated with a LTF and camp. First, there is the potential loss of wildlife habitat due to clearing for the camp, sort yard, and associated facilities. The second possible disturbance to wildlife is a result of increased human activity associated with the camp.

The amount of habitat lost is relatively minor. Whenever possible, camps and sort yard facilities are located away from the highest quality habitat. The differences between a slide facility and barge facility are inconsequential. The objectives are to avoid eagle nest sites and estuarine habitat.

The overall effects of disturbance of wildlife-use patterns are usually minor. Most wildlife species generally adapt to increased human use quickly.

Human activity associated with the camps and facilities may effect wildlife. This includes disturbance of wildlife-use patterns, increased harvest, and increased bear-human encounters.

An increase in the number of people in an area would generally increase the use of and competition for wildlife resources. However, actual harvest levels can be monitored and regulated. The influx of additional people into an area appears to have a greater potential to affect the existing users of the area than wildlife species. Wildlife populations may be affected by the LTFs or logging camps proposed in any of the alternatives. For additional information on the effects of the proposed alternatives on existing users, see the ANILCA, Section 810, Subsistence Evaluation and Finding in the Subsistence section of this chapter.

Visual Resources

The large size, linear bold shape, and saltwater location of LTFs generally dominate the landscape when viewed within a foreground distance. Their relatively low profile, however, helps to mitigate the visual impacts when viewed from a distance. The existing LTFs used in the project share similar components that offer the same visual impacts. There may be need of a sort/storage area for logs at newly constructed sites that are designated as low-angle ramps. Clearings for sort yards and logging camps of approximately the same size and located on fairly level or gently sloping sites help to absorb much of the visual contrasts when viewed from saltwater. It is expected that most camps will consist of floating camps. Accordingly, upland development will consist of maintenance shops and fuel storage systems. These

facilities will have less impact as they develop and will have less permanent disturbance. For more information, see the Visual Resources section of this chapter.

Long-term Productivity

This section compares the short-term effects of developing LTFs in the intertidal area to long-term accessibility (for timber management) and productivity in the area. Without a means to transfer logs into saltwater, the long-term opportunity to manage the uplands for commercial timber is lost. If LTFs were not approved by permitting agencies, the volume tributary to those facilities would not be available to meet contractual obligation.

It is assumed that other resources would have similar management opportunities with or without access to the uplands from saltwater (by an LTF). Table MAR-5 compares the number of acres potentially affected by each LTF to the number of acres of suitable timber tributary for each location.

Short-term use of 3 acres of estuarine habitat would provide access to approximately 13,300 acres of land suitable for timber production. This roughly equates to 372 MMBF to be available to meet commitments to the Ketchikan Area timber sale program.

Table MAR-5
Comparison of Short-term Uses to Long-term Productivity for the Estuarine System

LTF Name	VCUs Served by LTF	Acres Estimated Impact	Acres of Potential Harvest 1998-2004*	Acres of Future Harvest 2004-2140**
Lancaster Cove	677, 679, 680, 681, 682	1	3,651	5,200
North Arm Moira	681 and 682	1	1,175	1,255
W. Arm Cholmondeley	674 and 678	1	574	310

* Based on Alternative 6.
** Based on LSTA minus dropped units.

Other Environmental Considerations

Probable Adverse Environmental Effects that Cannot be Avoided

Implementation of any action alternative would result in some adverse environmental effects that cannot be effectively mitigated or avoided if the proposed action is to take place. The interdisciplinary procedure used to identify specific harvest units and roads was designed to eliminate or lessen the significant adverse consequences. In addition, the application of standards and guidelines, BMPs, mitigation measures, and a monitoring plan are intended to further limit the extent, severity, and duration of these effects. The specific environmental effects of the alternatives were discussed earlier in this chapter, and mitigation measures are described in Chapter 2. Although the formulation of alternatives included avoidance of potentially adverse environmental effects, some adverse impacts to the environment, which cannot be completely mitigated, may occur.

Although standards and guidelines, BMPs, and monitoring plans are designed to prevent significant adverse effects to soil and water, the potential for adverse impacts does exist. Sediment production would occur as long as roads are being built and timber is harvested.

Sediment would be produced by surface erosion, channel erosion, and mass movement.

Disturbance, displacement, or loss of fish and wildlife may occur as a consequence of habitat loss and increased human activity in the project area. New road construction and the human activities associated with new access to areas previously unroaded would result in impacts to fish and wildlife. Improved access into areas that previously had limited roads would have similar effects. The proposed activities would increase competition for subsistence resources.

Ground-disturbing activities could temporarily increase sediment loads in some streams. This could displace fish, reduce anadromous and resident fish reproductive success, and alter aquatic invertebrate populations. The portion of a stream bed occupied by a culvert or other crossing structure would be lost as fish habitat.

Both the amount and distribution of mature and old-growth stands would be reduced through implementation of any action alternative. The rate and severity of adverse impacts varies by alternative. Because some wildlife species rely on habitat conditions provided by old-growth stands, the reduction in the populations of some wildlife species could be expected. As old-growth and mature timber stands are converted to young even-aged stands, the capability of the project area to provide optimal habitat for old-growth dependent species would be reduced.

Timber harvest and road construction in areas that are currently unroaded would alter natural characteristics of these areas. This would modify the recreational experiences that are offered by these areas. Both Primitive and Semi-Primitive recreation opportunities will be lost by these actions. In addition, these development activities would result in a loss of opportunity to consider these areas in future revisions of the Forest Plan for designation as wilderness, roadless areas, research natural areas, or for other purposes requiring natural characteristics.

The natural landscape would appear visually altered by timber harvest, particularly where logging activity is highly visible from travel routes. These adverse effects would eventually be

reduced by growth of vegetation. Other impacts on the natural appearance of the landscape include roads and structures which are highly visible despite efforts to blend them with landforms and mitigate the effect by landscaping.

The intensity and duration of these effects depends on the alternative and the mitigation measures applied to protect the resources. Most unavoidable effects are expected to be short term (usually less than 2 to 5 years). In all cases, the effects would be managed to comply with established legal limits, such as maximum time for regeneration. To reduce these effects, monitoring procedures and mitigation measures have been planned for those areas which may be affected. Specific mitigation measures are documented in the unit and road cards.

Some adverse effects are of a transitory type. For example, air quality may diminish on a recurring, though temporary, basis due to road construction, timber harvest, timber hauling and recreation traffic on untreated roads, and due to the operation of internal combustion engines. Where they occur, these activities may have localized temporary adverse effects on air quality.

Relationship Between Short-term Uses and Long-term Productivity

All alternatives would come under the mandate of the Multiple Use and Sustained Yield Act of 1960, which requires the Forest Service to manage Forest System lands for multiple uses (including timber, recreation, fish and wildlife, range and watershed). All renewable resources are to be managed in such a way that they are available for future generations. The harvesting and use of standing timber can be considered a short-term use of a renewable resource. As a renewable resource, trees can be reestablished and grown again if the productivity of the land is not impaired.

Maintaining the productivity of the land is a complex, long-term objective. All alternatives protect the long-term productivity of the project area through the use of specific standards and guidelines, mitigative measures, and BMPs. Long-term productivity could change as a result of various management activities proposed in the alternatives. Timber management activities would have direct, indirect, and cumulative effects on the economic, social, and biological environment.

Soil and water are two key factors in ecosystem productivity, and these resources would be protected in all alternatives to avoid damage that could take many decades to rectify. Sustained yield of timber, wildlife habitat, and other renewable resources all rely on maintaining long-term soil productivity. Quality and quantity of water from the project area may fluctuate as a result of short-term uses, but no long-term effects to the water resource are expected to occur as a result of timber management activities.

All alternatives would provide the fish and wildlife habitat necessary to contribute to the maintenance of viable, well-distributed populations of existing native and desired non-native vertebrate species. The abundance and diversity of wildlife species depends on the quality, quantity, and distribution of habitat, whether used for breeding, feeding, or resting. Management Indicator Species (MIS) are used to represent the habitat requirements of all fish and wildlife species found in the project area. By managing habitats and populations of indicator species, the other species associated with the same habitat would also benefit. The alternatives provide standards, guidelines, and mitigation measures for maintaining long-term habitat and species productivity. The alternatives vary in the risk presented to both wildlife habitat and habitat capability.

Timber rotations are normally over a 100-year or longer rotation, depending upon site quality. To ensure adequate production of timber, harvest has been scheduled to allow the earliest cut stands to mature into merchantable timber before the planned harvest of original stands is complete. When the first rotation is complete, mature timber stands would be harvested again on a new rotation. Management of the timber resource on these rotations could affect long-term productivity, depending on the intensity of silvicultural practices. Projected timber rotation lengths are not anticipated to affect long-term productivity. Mitigation measures are planned under all the alternatives to ensure future availability of other renewable resources as well.

Opportunities for dispersed recreation use, including hiking, camping and fishing, would be maintained and increased for future generations. The setting in which these activities occur varies by alternative, but the long-term potential for the project area to provide a spectrum of recreation opportunities would be maintained in all alternatives.

Irreversible Commitments of Resources

Irreversible commitments are decisions affecting non-renewable resources such as soils, wetlands, unroaded areas, and cultural resources. Such commitments are considered irreversible because the resource has deteriorated to the point that renewal can occur only over a long period of time or at a great expense or because the resource has been destroyed or removed.

The construction of arterial and collector roads, to provide access to the Forest, is an irreversible action because of the time it takes for a constructed road to revert to natural conditions. Irreversible actions also include the associated rock quarries which are developed in conjunction with these roads. Alternative 1 would have no new road construction, while Alternatives 2, 3, 4, 5, and 6 would construct roads and quarries to harvest units as described under the Transportation section of this chapter. This will require that up to 60 acres of ground be irreversibly committed to rock quarries and up to 900 thousand cubic yards of rock fill to be placed for road construction and reconstruction.

Old-growth habitat lost due to logging can be considered an irreversible effect since it is not expected to regain old-growth characteristics for at least 150 years. Alternative 1 would not harvest any old growth, while Alternatives 2-6 would harvest old-growth timber as described in the Silviculture, Timber, Wildlife, and Biodiversity section of this chapter.

Loss of soil due to erosion and mass failures is an irreversible commitment of resources. However due to the incorporation of BMPs, Forest Plan standards and guidelines, and mitigation measures specified in this document, it is not anticipated that there would be any significant soil loss under any alternative.

Loss of cultural resource sites resulting from accidental damage or vandalism would be an irreversible commitment of resources. The standards and guidelines, survey methodology prior to activities, and mitigation measures specified in this document provide reasonable assurance that there would be no irreversible loss of cultural resources.

Irretrievable Commitments

Irretrievable commitment of natural resources means loss of production or use of resources due to management decisions made in the alternative. This represents opportunities foregone for the period of time that the resource cannot be used.

Foregoing timber harvest opportunities at this time in certain areas due to resource concerns or economics may represent an irretrievable commitment of resources because that volume cannot be harvested. The commitment is irretrievable rather than irreversible, because future entries could harvest those areas if they are still classified as part of the suitable timber base.

The reduction in the visual quality of an area due to timber harvesting will be an irretrievable commitment of resources. The commitment is irretrievable since viewsheds will typically heal from a visual quality standpoint after about 40 years. After this time, the second-growth trees will have the color and height needed so as not to be evident to the casual observer. Alternative 1 would have no irretrievable commitment of visual quality. Alternatives 2, 3, 4, 5, and 6 would irretrievably commit visual resources due to timber harvesting.

Possible Conflicts with Plans and Policies of Other Jurisdictions

The regulations for implementing NEPA require a determination of possible conflicts between the proposed action and the objectives of Federal, State, and local land-use plans, policies, and controls for the area. The major land-use regulations of concern are the Coastal Zone Management Act (CZMA), Section 810 of ANILCA, and the State of Alaska's Forest Practices Act. A discussion of each of these determinations is presented below.

Coastal Zone Management Act of 1976 (CZMA)

The CZMA was passed by Congress in 1976 and amended in 1990. This law requires Federal agencies conducting activities or undertaking development affecting the coastal zone to ensure that the activities or developments are consistent with approved state coastal management programs to the maximum extent practicable. The State of Alaska passed the Alaska Coastal Management Act in 1977, to establish a program that meets the requirements of the CZMA. It contains the standards and criteria for a determination of consistency for activities within the coastal zone.

The Forest Service has evaluated the alternatives to ensure that the activities and developments affecting the coastal zone are consistent with approved coastal management programs to the maximum extent practicable. The standards and guidelines for timber management activities in the Chasina Project Area meet or exceed those indicated in the Alaska Forest Practices Act and the Alaska Coastal Management Program (ACMP).

Evaluation of the proposed activities against standards and guidelines for activities within the coastal zone results in a finding that these activities are consistent with the ACMP to the greatest extent practicable. In accordance with the Memorandum of Understanding and Alaska statutes, the State of Alaska Office of Governmental Coordination will perform a preliminary consistency review of this Draft EIS.

Alaska National Interest Lands Conservation Act of 1980 (ANILCA)

Under Section 810 of ANILCA, agencies are required to evaluate the effects of proposed actions on subsistence uses of Federal land and to determine if the proposed action may significantly restrict subsistence opportunities. Refer to the Subsistence section of this chapter for the evaluation of impacts to subsistence use as a result of the alternatives.

State of Alaska's Forest Practices Act of 1990

On May 11, 1990, the governor approved the legislature's major revision of the State's Forest Practices Act (FPA). The revised act significantly increases the State's role in providing protection and management for important forest resources on state and private lands. The revised FPA will also affect National Forest management through its relationship to the ACMP and the Federal CZMA (see above discussion).

For National Forest timber operations, such as proposed for the Chasina Project, the effect of the revised FPA is essentially two-fold. First, it clarifies that the revised FPA regulations are the standard which must be used for evaluating timber harvest activities on Federal lands for purposes of determining consistency to the maximum extent practicable with the Alaska Coastal Zone Management Program. Secondly, it calls for minimum 100-foot buffers on all Class I streams and recognizes that consistency to the maximum extent possible for purposes of the ACMP is attainable in Federal timber harvest activities using specific methodologies which may differ from those required by the revised FPA or its implementing regulations.

The Forest Service has evaluated the alternatives to ensure that the activities and developments affecting the coastal zone are consistent with approved coastal management programs to the maximum extent practicable. The layout of all proposed harvest units comply with the TTRA requirements for stream buffers which exceed the stream buffer requirements in the Alaska FPA.

The Forest Service will evaluate the alternatives prior to completion of the Final EIS and the ROD to ensure that the activities and developments specifically covered by the FPA are consistent with its provisions to the maximum extent possible.

Energy Requirements and Conservation Potential of Alternatives

The implementation of the proposed actions in the project area will require the expenditure of energy (e.g., fuel consumption). The amount of energy used varies by alternative based on timber volume harvested and miles of road constructed or reconstructed. The direct effect of the alternatives on energy requirements would be attributed to timber harvest, road construction and reconstruction, and travel necessary to administer the timber sale. Indirect energy requirements include processing wood products and the transport of the products to secondary processors and consumers.

Fuel Consumption

Fuel consumption requirements were estimated as follows:

Timber Sale Preparation and Administration, 1.56 gallons/MBF
Cable Logging, 2 gallons/MBF
Helicopter Logging, 8 gallons/MBF
Load, Haul, Dump, and Tow, 8 gallons/MBF
Road Construction, 4,000 gallons/mile
Road Maintenance, 20 gallons/mile

The estimated total fuel consumption required for each alternative is displayed in Table MAR-6

Table MAR-6
Estimated Fuel Consumption by Alternative

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Thousands of gallons	0	447	805	1,110	1,007	1,700
Average gallons/MBF	0	13	15	13	15	14

Conservation Potential

To conserve fuel and/or minimize harvesting costs, the Forest Service has undertaken studies and allowed experimentation with new harvesting equipment and techniques. Shovel yarding is estimated to use 2.7 gallons of fuel per MBF, which is almost a gallon more per MBF than for cable yarding; however, savings are realized in labor costs. Labor cost per MBF is based on a crew size of 1-2 people for shovel yarding compared to an average of 4 people for cable yarding.

The use of low tire pressure equipment (central tire inflation--CTI) during road construction and logging has also shown to decrease costs during studies nationwide and on the Stikine Area of the Tongass National Forest. Studies on Mitkof Island indicate that 10 to 14 percent less rock was needed during road construction, resulting in cost savings of approximately $450,000. It is predicted that costs for rock replacement/road maintenance, log truck fuel, and tire repair and replacement will be decreased. Cost savings have proven to be substantial enough that the Forest Service provides a contract clause allowing a reduction in rock replacement deposits when low tire pressure equipment is used.

The use of cable yarding equipment fitted with mechanical or hydraulic interlocks, provides the ability to decrease yarding expense as the throttle and brake do not have to be ridden simultaneously to provide deflection for the turn of logs.

Natural or Depletable Resource Requirements and Conservation Potential

All alternatives considered in detail are designed to conform to applicable laws and regulations pertaining to natural or depletable resources, including minerals and energy resources. Regulation of mineral and energy activities on the National Forest, under the U.S. Mining Laws Act of 1872, and the Mineral Leasing Act of 1920, is shared with the Bureau of Land Management (BLM). The demand for access to National Forest system lands for the purpose of mineral and energy exploration and development is expected to increase over time.

The action alternatives propose road construction that would increase opportunities for access to the National Forest within the project area. This increased access may result in increased activity with regard to both known and potential mineral or energy resource occurrences. The actual potential for increased mineral or energy resource activity in the project area is not known, nor can an accurate estimate be made.

Urban Quality, Historic and Cultural Resources

The project area contains no urban areas. Therefore, the only applicable concern under this topic is with historic and cultural resources. The goal of the Forest Service's Cultural Resource Management Program is to preserve significant cultural resources in their field setting and ensure they remain available in the future for research, social/cultural purposes, recreation, and education. The direct, indirect, and cumulative effects of the alternatives on cultural resources have been evaluated. The result of this evaluation is the determination that there are adequate standards, guidelines, and procedures to protect cultural resources and to meet the goals of the Cultural Resource Management Program. Cultural resources are discussed further in the Cultural section of this chapter.

Consumers, Civil Rights, Minorities and Women

All Forest Service actions have the potential to produce some form of impact, positive and/or negative, on the civil rights of individuals or groups, including minorities and women. The need to conduct an analysis of this potential impact is required by Forest Service Manual and Forest Service Handbook direction. The purpose of the impact analysis is to determine the scope, intensity, duration, and direction of impacts resulting from a proposed action. For environmental or natural resource actions, such as proposed for the project area, the civil rights impact analysis is an integral part of the procedures and variables associated with the social impact analysis. This analysis is discussed in the Socio-Economic section of this chapter.

The effect of the alternatives on consumers is reflected in the discussion of the various goods and services supplied as a result of the proposed actions. This analysis occurs throughout the chapter as an integral part of the analysis of the effects on other components of the environment.

Prime Farmland, Rangeland, and Forest Land

All alternatives are in keeping with the intent of Secretary of Agriculture Memorandum 1827 for prime land. The project area does not contain any prime farmlands or rangelands. Prime forest land does not apply to lands within the National Forest system. In all alternatives, lands administered by the Forest Service would be managed with a sensitivity to the effects on adjacent lands.

Threatened and Endangered Species, and Critical Habitat

There will be no adverse impacts to any Federally listed threatened or endangered species or critical habitat as a result of this project. No endangered or threatened wildlife species are known to occur in the project area, although humpback whales and Steller sea lions are occasionally found in waters bordering the project area. The discussion of the effects of the alternatives on threatened, endangered, or sensitive species is presented in the Threatened and Endangered Species section of this chapter.

Chapter 4

Lists

Outline

List of Preparers

The following is a list of contributors to this EIS. Other Forest Service employees contributed to the completion of this document through their assistance in support functions. Their help is greatly appreciated.

Members of the Interdisciplinary Team (IDT)

Norm Matson, Chasina EIS Team Leader

Education
B.S., Wildlife-Game Management, University of Wisconsin-Stevens Point, 1973
Forest Service: 23 years
Planning Biologist, Tongass NF, Ketchikan Area, 4 years
Wildlife Biologist, Tongass NF, Craig RD, 2 years
Timber Sale Administrator/Wildlife Biologist, Chippewa NF, Blackduck RD, 12 years
Recreation/Forestry Technician, Chequamegon NF, Hayward RD, 5 years

Gary Lawton, Forester-Assistant Team Leader

Education
B.S., Forest Science, University of Wisconsin-Madison, 1975
Forest Service: 19 years
Silviculturist, Tongass NF, Ketchikan Area, Craig RD, 1 year
Silviculturist, Blackhills NF, Deadwood SD, 7 years
Silviculturist/Reforestation Forester, Tongass NF, Thorne Bay RD, 6 years
Forester, Tongass NF, Stikine Area, Kake, 2 years
Presale Forester, Stikine Area, Petersburg RD, 3 years

Roger Johnson, Soil Scientist

Education
B.S., Forest Science, University of Minnesota
M.S., Forest Soils, University of Minnesota
Forest Service: 5.5 years
Soil Scientist, Tongass NF, Ketchikan Area, 5.5 years

Ron Gendreau, GIS Coordinator

Forest Service: 23 years
Systems Analyst, Tongass NF, Ketchikan Area, 4 years
Transportation Planner, Tongass NF, Ketchikan Area, 2 years
Project Engineer, Tongass NF, Stikine Area, 6 years
District Engineer, Tongass NF, Cordova Ranger District, 1 year
Construction Inspector, Gifford Pinchot NF, 2 years
Road Maintenance Supervisor-Idaho Panhandle NF's, 8 years

Deyna Kuntzsch, Fish Biologist

Education
B.S., Water Resources (Fisheries Emphasis) and Biology, University of Wisconsin-Stevens Point, 1991
Forest Service: 7 years
District Fisheries Biologist, Tongass NF, Craig RD, 2 years
Zone Fisheries Biologist, Manistee NF, Manistee, MI, 3 years
Fisheries Bio. Trainee, Huron-Manistee NF, Cadillac, MI, 2 years
Other Relevant Experience
Fish Project Crew Leader, Wisconsin DNR-YCC, Kettle Marine, WI; 3 years

Marla Dillman, Wildlife Biologist

Education
B.S., Wildlife Ecology, University of Wisconsin-Madison, 1984
Forest Service: 12 years
Biological Technician-Wildlife, Tongass NF, Craig RD, 7 years
Biological Technician-Fisheries, Tongass NF, Ketchikan RD, 2 years
Biological Technician-Wildlife, Tongass NF, Forestry Sciences Lab., Juneau, AK, 2 years
Wildlife Volunteer, Tongass NF, Ketchikan AK, 1 year

Jim Baichtal, Geologist

Education
Associate Science Degree, LCC, Longview, WA, 1977
B.S. in Geology, Washington State University, 1980
M.S. in Geology, Washington State University, 1982
Forest Service: 12 years
Forest Geologist, Tongass NF, Ketchikan Area, 6 years
Resource Geologist, Umpqua NF, Roseburg, OR, 2.5 years
Engineering Geologist, Ochoco NF, Prineville, OR, 3.5 years
Other Relevant Experience
Engineering Geologist, U.S. Army Corps of Engineers, Ft. Worth TX, 1.5 years.
Instructor, Geology field camp for Paleontology Lab, Washington State University, 2 summers 1978/79.
Operated a Geologic Consulting business, Roseburg, Oregon

Joan Kluwe, Recreation Forester

Education
B.S., Forestry-Outdoor Recreation Management, Southern Illinois University at Carbondale, 1985
M.S., Forestry, Southern Illinois University-Carbondale, 1987
Forest Service: 7 years
Recreation Forester, Tongass NF, Craig RD, 1 year
Recreation Forester, Mt. Hood NF at Estacada, Zigzag, and Clackamas RD's, 6 years
Other Relevant Experience
Forester/Real Estate Appraiser, US Fish and Wildlife Service, McAllen, TX, 1 year
Forestry Technician/Wilderness, White River NF, Sopris RD, 3 seasons
Park Aid, US Army Corps of Engineers, Rend Lake, Benton, IL, 1 season

Terry Fifield, Archeologist

Education
B.S., Geology, Sunny College at Cortland, 1978
M.S., Anthropology, Eastern New Mexico University-Portales, 1987
Forest Service: 6 years
Zone Archaeologist, Tongass NF, Craig/Thorne Bay RD's, 2 years
District Archaeologist, Ochoco NF, Burns OR, 2 years
Archaeologist, Tongass NF, Ketchikan Area, 2 years
Other Relevant Experience
Archaeologist Crew Chief, USDI Nat'l Park Service, Anchorage AK, 1 year
Archaeologist, Bureau of Indian Affairs, Anchorage AK, 2 years
Archaeologist, Eastern New Mexico University, 5 years intern
Archaeologist Technician, BIA, Anchorage AK, 2 years
Archaeologist, BLM, Albuquerque, New Mexico, 1 year

Jack Oien, Transportation Planner

Forest Service: 20 years
Transportation Planner, Tongass NF, Ketchikan Area, 2 years
Project Engineer, Tongass NF, Ketchikan Area, 5 years
Transportation Planner, Mt. Baker Snoqualmie NF, 2 years
Project Engineer, Tongass NF, Ketchikan Area, 4 years
Construction Inspector, Lolo NF, 7 years

John Short, Landscape Architect

Education
B.S., Journalism, minor in Landscape Architecture, Cornell University 1967
M.L.A. Landscape Architecture, Cornell University, 1975
Forest Service: 19 years
Forest Landscape Architect, Tongass NF, Ketchikan Area
Other Relevant Experience
Landscape Architect with City Planning Dept., Ithaca NY, 1975 for 6 months

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Additional Support

Diane Weisert - Writer/Editor
Joyce Martin - Writer/Editor
Julie Benson - Writer/Editor
James Llanos - GIS, Wildlife Models
Pete Klein - GIS, Harvest Units, Mid-market Analysis
Sally Merfeld - GIS, Streams
Paul Zellmer - GIS, Fish Models
Gerald Lemke - GIS
Ted Geier - Watershed Analysis
Jim Rhodes - Log Transfer Facilities
Don Ranne - Lands/Permits
Hank Newhouse - Subsistence
Dennis Landwehr - Field Recon, Soils
Glenn Pierce - LSTA
Annette Anderson - Stand Exam Contract
Erich Grebner - Unit Database, Helicopter Analysis
Mike Sheets - Helicopter Analysis
John Hannon - Field Recon, Streams
Kevin Buckley - Field Recon, Streams
John Frank - Field Recon, Streams
Karen McCartney - Field Recon, Streams
Martin Becker - Field Recon, Streams
Doreen Parker - Field Recon, Wildlife
Manual Pacheco - Field Recon, Wildlife
Barb Johnston - Field Recon, Wildlife
Jennifer Wrate - Field Recon, Wildlife
Cathy Tighe - Field Recon, Wildlife
Barney Freedman - Field Recon, Roads
Bill Steel - Field Recon, Roads
Rich Reeves - Field Recon, Roads
Devin Kennemore - Field Recon, Botany
Frank Broderick - Field Recon, Cultural Resources
Diane Hanson - Field Recon, Cultural Resources

Glossary

Access
The opportunity to approach, enter, and make use of public lands.

Access Management
Acquiring rights and developing and maintaining facilities needed by people to get to and move through public lands (physical attributes).

Active Channel
Unstable portion of a stream where stream channels are frequently changing course.

Adfluvial Fish
Species of populations of fish that do not go to sea, but live in lakes, and enter streams to spawn.

Aelvin
Young salmon that are still attached to the yolk sac, which provides nourishment.

Aerial Harvest Systems
Harvesting methods in which the cut logs are moved from the stump to the loading area or log deck without touching the ground, for example helicopter logging.

Aggradation
The process of building up a land surface by deposition.

Alaska National Interest Lands Conservation Act (ANILCA)
Passed by Congress in 1980, this legislation designated 14 National Forest wilderness areas in Southeast Alaska. The Alaska National Interest Lands Conservation Act of December 2, 1980. Public Law 96-487, 96th Congress, 94 Stat. 2371-2551. In Section 810 requires evaluations of subsistence impacts before changing the use of these lands.

Alaska Native Claims Settlement Act (ANCSA)
Public Law 92-203, 92nd Congress, 85 Stat. 2371-2551. Approved December 18, 1971, ANCSA provides for the settlement of certain land claims of Alaska natives and for other purposes.

Allowable Sale Quantity (ASQ)
ASQ refers to the maximum quantity of timber that may be sold each decade from the Tongass National Forest. This quantity, expressed as a board foot measure, is calculated per timber utilization standards specified in the Alaska Regional Guide, the number and type of acres available for timber management, and the intensity of timber management. The ASQ was calculated at 4.5 billion board feet per decade for the Tongass National Forest.

Alluvial Fan
A cone-shaped deposit of organic and mineral material made by a stream where it runs out onto a level plain or meets a slower stream.

Alluvium
Material deposited by rivers or streams, including the sediment laid down in river beds, flood plains and at the foot of mountain slopes and estuaries.

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Alpine
Parts of mountains above tree growth and/or the organisms living there.

Alternative
One of several policies, plans, or projects proposed for decision making.

Anadromous Fish
Anadromous fish (such as salmon, steelhead, and sea run cutthroat trout) spend part of their lives in freshwater and part of their lives in saltwater.

Anadromous Species
One whose individuals are born in freshwater but migrate to and feed in the sea before returning to freshwater to breed.

Aquatic Habitat Management Unit (AHMU)
A mapping unit that displays an identified value for aquatic resources. It is a mechanism for carrying out aquatic resource management policy.
Class I AHMU: Streams with anadromous or high-quality sport fish habitat. Also included is the habitat upstream from migration barriers known to have reasonable enhancement opportunities for anadromous fish.
Class II AHMU: Streams with resident fish populations and generally steep (6 to 15 percent) gradient (can also include streams from 0 to 6 percent gradient where no anadromous fish occur). These populations have limited sport fisheries values and are separate from the high-quality sport fishing systems included in Class I. They generally occur upstream of migration barriers or are steep gradient streams with other habitat features that preclude anadromous fish use.
Class III AHMU: Streams with no fish populations but have potential water quality influence on the downstream aquatic habitat.

Background
The distant part of a landscape. The seen or viewed area located from three or five miles to infinity from the viewer. (See "Foreground" and "Middleground".)

Beach Fringe Use Area
Non-forested wildlife use areas that occur from the intertidal zone inland 500 feet and islands of less than 50 acres. Forested wildlife use areas that occur from the intertidal zone inland 600 feet and islands of less than 50 acres.

Bedload
Sand, silt, and gravel, or soil and rock debris rolled along the bottom of a stream by the moving water.

Benthic
Refers to the substrate and organisms in and on the bottom of a body of water.

Best Management Practice (BMP)
Practices used for the protection of water quality. BMPs are designed to prevent or reduce the amount of pollution from nonpoint sources or other adverse water quality impacts while meeting other goals and objectives. BMPs are standards to be achieved, not detailed or site specific prescriptions or solutions. BMPs as defined in the USDA Forest Service Soil &Water Conservation Handbook are mandated for use in Region 10 under the Tongass Timber Reform Act.

Biological Diversity (Biodiversity)
The variety of life in all its forms and at all levels. This includes the various kinds and combinations of: genes; species of plants, animals, and microorganisms; populations; communities; and ecosystems. It also includes the physical and ecological processes that allow all levels to interact and survive. The most familiar level of biological diversity is the species level, which is the number and abundance of plants, animals, and microorganisms.

Biological Potential
The maximum possible output of a given resource limited only by its inherent physical and biological characteristics.

Biomass
The total quantity, at a given time, of living organisms of one or more species per unit area or all of the species in a community.

Biotic
Refers to life, living. See also, abiotic.

Blowdown
See windthrow.

Board Foot (BF)
A unit of wood 12" X 12" X 1". One acre of commercial timber in Southeast Alaska on the average yields 28,000-34,000 board feet per acre (ranging from 8,000-90,000 board feet per acre). One million board feet (MMBF) would be the volume of wood covering one acre two feet thick. One million board feet yields approximately enough timber to build 120 houses or 75,555 pounds of dissolving pulp.

Bole
Trunk of the tree.

Braided Streams or Channels
A stream flowing in several dividing and reuniting channels resembling the strands of a braid, the cause of division being the obstruction by sediment deposited by the stream.

Broadcast Burning
Burning of an area that has been clearcut to remove logging slash from the site. Broadcast burning is done to prepare sites for regeneration or improve wildlife habitat.

Brush Disposal
Cleanup and disposal of slash and other hazardous fuels within the forest or project areas.

Buffer
Tongass Timber Reform Act (TTRA) requires that timber harvest be prohibited in an area no less than 100 feet on each side of all Class I streams and Class II streams which flow directly into Class I streams. This 100-foot area is known as a buffer.

Cant
A log partly or wholly cut and destined for further processing.

Capability
An evaluation of a resource's inherent potential for use.

Carryover
Timber volume designated for harvest in a five-year operating period but not harvested during that period. It is available, therefore, for subsequent five-year operating periods.

Channel Migration
Movement of a stream or river channel within a floodplain area usually over an extended period of time.

Clearcut
The harvesting in one cut of all trees on an area. The area harvested may be a patch, strip, or stand large enough to be mapped or recorded as a separate class in planning for sustained yield. Clearcut size on the Tongass National Forest is limited to 100 acres, except for specific conditions noted in the Alaska Regional Guide.

Climax
A community of plants and animals which is relatively stable over time and which represents the late stages of succession under current climate and soil conditions.

Code of Federal Regulations (CFR)
A codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the Federal Government.

Commercial Forest Land (CFL)
Productive Forest land that is producing or capable of producing crops of industrial wood and is not withdrawn from timber utilization by statute or administrative regulation. This includes areas suitable for management and generally capable of producing in excess of 20 cubic feet per acre of annual growth or in excess of 8,000 board feet net volume per acre. It includes accessible and inaccessible areas.

Normal CFL: Timber that can be economically harvested with locally available logging systems. Composed of two categories:

Standard: Timber that can be economically harvested with locally available logging systems, such as highlead or short-span skyline.

Special: Timber that is in areas where special consideration is needed to protect other resources but can be harvested with locally available logging systems.

Non-standard CFL: Timber that cannot be harvested with locally available logging systems and would require the use of other logging systems such as helicopter or long-span skyline.

Commercial Thinning
Thinning a stand where the trees to be removed are large enough to sell.

Confluence
The point where two streams meet.

Corridor
Connective links of certain types of vegetation between patches of suitable habitat which are necessary for certain species to facilitate movement of individuals between patches of suitable habitat. Also refers to transportation or utility rights-of-way.

Cover
Refers to trees, shrubs, or other landscape features that allow an animal to partly or fully conceal itself.

Critical Habitat
Specific terrain within the geographical area occupied by threatened or endangered species. Physical and biological features that are essential to conservation of the species and which may require special management considerations or protection are found in these areas.

Crown
The tree canopy. The upper part of a tree or woody plant that carries the main branch system and foliage.

Cruise
Refers to the general activity of determining timber volumes and quality as opposed to a specific method.

Cull Logs
Trees that do not meet certain quality specifications.

Culmination Mean Annual Increment (CMAI)
The point at which a tree (or stand) achieves its highest average growth, based on expected growth according to the management intensities and utilization standards assumed in the Forest Plan.

Cultural Resources
Historic or prehistoric objects, sites, buildings, structures, and their remains, resulting from past human activities.

Cumulative Effects
The impacts on the environment resulting from additional incremental impacts of past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions occurring over time.

Cutover
Areas harvested recently.

dbh (DBH)
Diameter Breast Height. The diameter of a tree measured 4 feet 6 inches from the ground.

Debris Avalanche
The sudden movement downslope of the soil mantle; it occurs on steep slopes and is caused by the complete saturation of the soil from prolonged heavy rains. Also known as a debris slide.

Debris Flow
A general term for all types of rapid movement of debris downslope.

Debris Torrents
Landslides that occur as a result of debris; avalanche materials which either dam a channel temporarily or accumulate behind temporary obstructions such as logs and forest debris.

Deer Winter Range
Locations that provide food and shelter for Sitka black-tail deer under moderately severe to severe winter conditions.

Degradation
The general lowering of the surface of the land by erosive processes, especially by the removal of material through erosion and transportation by flowing water.

Demographic
Pertaining to the study of the characteristics of human populations, such as size, growth, density, distribution, and vital statistics.

Detritis
Material, produced by the disintegration and weathering of rocks, that has been moved from its site of origin.

Developed Recreation
Recreation that requires facilities that, in turn, result in concentrated use of an area. Facilities in these areas might include roads, parking lots, picnic tables, toilets, drinking water, and buildings.

Direct Employment
The jobs that are immediately associated with the Long-Term Contract Timber Sale, including, for example, logging, sawmills, and pulpmills.

Discount Rate
The rate used to adjust future benefits or costs to their present value.

Dispersion
To disperse the effects of timber harvest by distributing harvest units more or less uniformly throughout a drainage so that increased runoff and sediment from disturbed sites will be buffered by lower levels of runoff and sediment production from surrounding undisturbed lands.

Dissected Landforms
A physical, recognizable form or feature of the earth's surface such as a mountain, hill, or valley having a characteristic shape, that in part is the result of several shallow or deeply incised drainage channels.

Dissolved Oxygen
The amount of free (not chemically combined) oxygen in water.

Distance Zone
Areas of landscapes denoted by specified distances from the observer (foreground, middleground, or background). Used as a frame of reference in which to discuss landscape characteristics of management activities.

Diversity
The distribution and abundance of different plant and animal communities and species within the area controlled by the Forest Plan.

Draft Environmental Impact Statement (DEIS)
A statement of environmental effects for a major Federal action which is released to the public and other agencies for comment and review prior to a final management decision. Required by Section 102 of the National Environmental Policy Act (NEPA).

Eagle Nest Tree Buffer Zone
A 330-foot radius around eagle nest trees established in an Agreement between the U.S. Fish and Wildlife Service and the Forest Service.

Ecosystem
A community of organisms and its physical setting. An ecosystem, whether a fallen log or an entire watershed, includes resident organisms, non-living components such as soil nutrients, inputs such as rainfall, and outputs such as organisms that disperse to other ecosystems.

Ecotone
A transition or junction zone between two or more naturally occurring diverse plant communities (ecosystems).

Ecotype
A species of plant or animal that displays different genetic or physiological adaptations. For example, the brown bear in Southeast Alaska is the same species as the grizzly bear in interior Alaska, but the brown bear is generally larger than the grizzly.

Effects
Effects, impacts, and consequences as used in this environmental impact statement are synonymous. Effects may be ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historical, cultural, economic, or social, and may be direct, indirect, or cumulative.
Direct Effects: Results of an action occurring when and where the action takes place.
Indirect Effects: Results of an action occurring at a location other than where the action takes place and/or later in time, but in the reasonably foreseeable future.
Cumulative Effects: See Cumulative Effects.

Encumbrance
A claim, lien, charge, or liability attached to and binding real property.

Endangered Species
Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act. See also, threatened species, sensitive species.

Environmental Analysis (EA)
A comprehensive evaluation of alternative actions and their predictable short-term and long-term environmental effects, which include physical, biological, economic, social, and environmental design factors and their interactions. An EA is less comprehensive than an Environmental Impact Statement (EIS), and may result in a Finding of No Significant Impact; should the EA reveal significant impacts, a full EIS must then be conducted.

Erosion
The wearing away of the land surface by running water, wind, ice, gravity, or other geological activities.

Escapement
Adult anadromous fish that escape from all causes of mortality (natural or human-caused) to return to streams to spawn.

Estuarine Fringe Use Area
A 1,000-foot timbered zone around an estuary.

Estuary
For the purpose of this EIS process, estuary refers to the relatively flat, intertidal, and upland areas generally found at the heads of bays and mouths of streams. They are predominately mud and grass flats and are unforested except for scattered spruce or cottonwood.

Even-Aged Management
The application of a combination of actions that result in the creation of stands in which trees of essentially the same age grow together. The difference in age between trees in forming the main canopy level of a stand usually does not exceed 20 percent of that age of the stand at harvest rotation age. Clearcut, shelterwood, or seed tree cutting methods produce even-aged stands.

Executive Order
An order or regulation issued by the President or some administrative authority under his or her direction.

Existing Visual Condition
The level of visual quality or condition presently occurring on the ground. The six existing visual condition categories are:

Type I: Natural Condition. Areas in which only ecological change has taken place. Corresponds to the Preservation VQO.

Type II: Natural appearing. Areas in which changes in the landscape are not noticed by the average forest visitor unless pointed out. Corresponds to the Retention VQO.

Type III: Slightly altered. Areas in which changes in the landscape are noticed, but do not attract attention. Corresponds to the Partial Retention VQO.

Type IV: Moderately altered. Areas in which changes in the landscape are easily noticed and may attract attention. Corresponds to the Modification VQO.

Type V: Heavily altered. Areas in which changes in the landscape obviously appear to be major disturbances and stand out as a dominating impression of the landscape. Corresponds to the Maximum Modification VQO.

Type VI: Drastically altered. Areas in which changes in the landscape are in glaring contrast to a natural appearance. Not a VQO.

Falldown (Hard and Soft Falldown)
The difference between planned or scheduled harvest and that which is attained after implementation is defined as Falldown. Hard Falldown occurs during harvest unit planning/design, layout, and during timber harvest and results in changes to the suitable timber base. Examples include previously unidentified small areas of poor soil stability, rock outcrops, v-notches, and small noncommercial forest sites. Soft Falldown occurs during harvest unit planning/design, layout, and occasionally during timber harvest and results in generally short-term deferrals (5-10 years) and typically do not affect the Forest Plan ASQ database.

Final Environmental Impact Statement (FEIS)
The final version of the statement of environmental effects required for major federal actions under Section 102 of the National Environmental Policy Act. It is a revision of the draft environmental impact statement (DEIS) to include public and agency responses to the draft. The decision maker chooses which alternative to select from the Final EIS, and subsequently issues a Record of Decision (ROD).

Fiscal Year (FY)
October 1 through September 30, e.g. October 1, 1992 - September 30, 1993 = FY93.

Floodplain
That portion of a river valley, adjacent to the river channel, which is covered with water when the river overflows its banks at flood stages.

Fluvial
Of or pertaining to streams and rivers.

Foreground
The stand of trees immediately adjacent to a scenic area, recreation facility, or forest highway; area located less than 1/4 mile from the viewer. See also, Background and Middleground.

Forest and Rangeland Renewable Resources Planning Act of 1976 (RPA)
Amended in 1976 by the National Forest Management Act. See RPA Assessment and Program.

Forest or Forest Land
National Forest lands currently supporting or capable of supporting forests at a density of 10 percent crown closure or better. Includes all areas with forest cover, including old growth and second growth, and both commercial and non-commercial forest land.

Forested Wetland
A wetland whose vegetation is characterized by an overstory of trees that are 20 feet or taller.

FORPLAN
The forest planning model. A linear programming software package used to analyze planning decisions regarding land use patterns, capital investment, and timber harvest scheduling.

FSH
Forest Service Handbook.

FSM
Forest Service Manual.

Geographic Information System (GIS)
An information processing technology to input, store, manipulate, analyze, and display spatial and attribute data to support the decision-making process. It is a system of computer maps with corresponding site specific information that can be electronically combined to provide reports and maps.

Geomorphology
The study of the forms of the land surface and the processes producing them. Also the study of the underlying rocks or parent materials and the landforms present which were formed in geological time.

Glide or Placid Streams
Grouping of channel types (L1 and L2) that have fairly consistent physical characteristics occurring on lowland landforms and are mostly associated with bogs, marshes, or lakes.

Groundwater
Water within the earth that supplies wells and springs.

Guideline
A preferred or advisable course of action or level of attainment designed to promote achievement of goals and objectives.

Habitat
The sum total of environmental conditions of a specific place occupied by an organism, population, or community of plants and animals.

Habitat Capability
The number of healthy animals that a habitat can sustain. Used in wildlife models to calculate rough population estimates for Management Indicator Species.

Habitat Improvement
Management of wildlife and fish habitat to increase their capability.

Hard Snags/Soft Snags
Hard snags are dead trees which have little decay and are generally still hard wood. Soft snags are dead trees which have a considerable amount of decay and are generally soft, broken wood.

Haul out
An area of large, smooth rocks used by seals and sea lions for resting and pupping.

Humus
Substance of organic origin that is fairly but not entirely resistant to further bacterial decay.

Hydrophyte
Plants typically found in wet habitats.

IMPLAN
A computer-based system used by the Forest Service for constructing nonsurvey input/output models to measure economic input. The system includes a data base for all counties in the United States and a set of computer programs to retrieve data and perform the computational tasks for input/output analysis.

Indirect Employment
The jobs in service industries that are associated with the Long-Term Contract timber sale including for example suppliers of logging and milling equipment.

Inoperable Timber
Timber that cannot be harvested by any proven method because of potential resource damage, extremely adverse economic considerations, or physical limitations.

Interdisciplinary Team (IDT)
A group of people with different backgrounds assembled to research, analyze, and write a project Environmental Impact Statement. The team is assembled out of recognition that no one scientific discipline is sufficiently broad enough to adequately analyze a proposed action and its alternatives.

Invertebrates
Animals without a backbone.

Irretrievable Commitments
Losses of production or use of renewable natural resources for a period of time. For example, timber production from an area is irretrievably lost during the time an area is allocated to a no-harvest prescription; if the allocation is changed to allow timber harvest, timber production can be resumed. The production lost is irretrievable, but is not irreversible.

Irreversible Commitments
Decisions causing changes which cannot be reversed. For example, if a roadless area is allocated to allow timber harvest and timber is actually harvested, that area cannot, at a later date, be allocated to wilderness. Once harvested, the ability of that area to meet wilderness criteria has been irreversibly lost. Often applies to nonrenewable resources such as minerals and cultural resources.

Issue
A point, matter, or section of public discussion or interest to be addressed or decided.

Knutsen-Vandenburg Fund (KV)
The portion of timber sale receipts collected and used for reforestation and other renewable resource projects on the sale area.

Land Allocation
The decision to use land for various resource management objectives to best satisfy the issues, concerns and opportunities and meet assigned forest output targets.

Land Exchange
The conveyance of non-Federal land or interests to the United States in exchange for National Forest System land or interests in land.

Land Use Designation (LUD)
The method of classifying land uses presented in the Tongass Land Management Plan (TLMP). Land uses and activities are grouped to define, along with a set of coordinating policies, a compatible combination of management activities. The following is a description of the four classifications:

LUD I: Wilderness areas. Undeveloped areas managed for solitude and primitive types of recreation, and containing unaltered habitats for plant and animal species.

LUD II: Lands to be managed in a roadless state in order to retain their wildland character; permits wildlife and fish habitat improvement as well as primitive recreation facility and road development under special authorization.

LUD III: Lands to be managed for a variety of uses. The emphasis is on managing for uses and activities in a compatible and complimentary manner to provide the greatest combination of benefits.

LUD IV: Lands that provide opportunities for intensive resource use and development where the emphasis is primarily on commodity or market resources.

Land Use Prescriptions
Specific management direction applied to a defined area of land to attain multiple use and other goals and objectives.

Landslides
The moderately rapid to rapid down slope movement of soil and rock materials that may or may not be water-saturated.

4 Lists

Large Woody Debris (LWD)
Any large piece of relatively stable woody material having a diameter of at least four inches and a length greater than three feet that intrudes into the stream channel. Also called Large Organic Debris (LOD).

Log Transfer Facility (LTF)
A facility that is used for transferring commercially harvested logs to and from a vessel or log raft, or the formation of a log raft. It is wholly or partially constructed in waters of the United States and location and construction are regulated by the 1987 Amendments to the Clean Water Act. Formerly termed "terminal transfer facility" or "log dump".

Logging Systems
Highlead: A cable yarding system, using a two-drum yarder, in which lead blocks are hung on a spar or tower to provide lift to the front end of the logs. Grabinski is a modified highlead cable system.

Aerial Logging Systems: Systems where the cut logs are moved from the stump to the loading area or log deck without touching the ground.

Live skyline/gravity carriage return: A two-drum, live skyline yarding system in which the carriage moves down the skyline by gravity; thus, is restricted to uphill yarding; the skyline is lowered to attach logs then raised and pulled to the landing by the mainline.

Live skyline/haulback required: A live skyline yarding system composed of skyline, mainline, and haulback; the carriage is pulled to the woods by the haulback; the skyline is lowered to permit the chokers to be attached to the carriage, and the turn is brought to the landing by the mainline.

Running skyline: A yarding system with three suspended moving lines, generally referred to as the main, haulback, and slack-pulling, that when properly tensioned will provide lift, travel, and control to the carriage; normally indicates a gantry type tower and a three-drum yarder.

Standing skyline: Used wherever yarding distances or span distances exceed the capability of live skyline equipment.

Multispan skyline: European equipment is commonly associated with this.

Tractor: Used to describe the full range of surface skidding equipment, designed to operate on level to downhill settings.

Shovel: A system of short-distance logging in which logs are moved from the stump to the landing by repeated swinging with a swing-boom log loader; the loader is walked off the haul road and out into the harvest unit; logs are moved and decked progressively closer to the haul road with each pass of the loader; when logs are finally decked at roadside, the same loader, or a different loader, loads out trucks. On gentle ground, logs are either heeled and swung or dragged by the boom as it rotates; larger log length and tree length logs are usually dragged to maintain machine stability. Soils should be moderate to well drained and side slopes must be less than 20 percent; passes or stripes should be kept to a maximum of four.

Helicopter: Flight path cannot exceed 40 percent downhill or 30 percent uphill; landings must be selected so there is adequate room for the operation and so that the helicopter can make an upwind approach to the drop zone.

A-Frame: Beach fringe timber which is logged with a float mounted yarder typically rigged in a highlead configuration for direct A-frame yarding.

Cold-deck and swing: Planned to access areas not suitable for skyline operations.

MBF
A thousand board feet net sawlog and utility volume.

MMBF
A million board feet net sawlog and utility volume.

MMCF
A million cubic feet net sawlog and utility volume.

Management Area
An area one or more VCUs in size for which management direction was written in the Tongass Land Management Plan.

Management Indicator Species (MIS)
Species selected in a planning process that are used to monitor the effects of planned management activities on viable populations of wildlife and fish, including those that are socially or economically important.

Management Prescriptions
Method of classifying land uses presented in the Tongass Land Management Plan (TLMP) Revision DEIS. Replaces the Land Use Designations (LUDs) originally presented in TLMP.

Management Requirement
Standards for resource protection, vegetation manipulation, silvicultural practices, even-aged management, riparian areas, soil and water and diversity, to be met in accomplishing National Forest System goals and objectives. (see 36 CFR 219.17)

Mass Failure
The downslope movement of a block or mass of soil. This usually occurs under conditions of high-soil moisture and does not include individual soil particles displaced as surface erosion.

Maritime Climate
Weather conditions controlled by an oceanic environment characterized by small annual temperature ranges and high precipitation.

McGilvery (Soil series)
Soil series which represents the only well-drained organic soil found in the Ketchikan Area. It is composed of a thin surface layer (less than 8 inches deep) of organic material overlying bedrock. These soils are associated with cliffs and rock outcrops, and are sensitive to disturbance.

Mean Annual Increment (MAI)
The total volume of a stand divided by its age.

Memorandum of Understanding (MOU)
A legal agreement between the Forest Service and others agencies resulting from consultation between agencies that states specific measures the agencies will follow to accomplish a large or complex project. A memorandum of understanding is not a fund obligating document.

Microclimate
The temperature, moisture, wind, pressure, and evaporation (climate) of a very small area that differs from the general climate of the larger surrounding area.

Middleground
The visible terrain beyond the foreground where individual trees are still visible but do not stand out distinctly for the landscape; area located from 1/4 to 5 miles from the viewer. See also, Foreground and Background.

Mineral Soils
Soils consisting predominately of, and having its properties determined by, mineral material.

Minimum Viable Population
The low end of the number of individuals of a species needed to ensure the long-term existence of the species.

Mining Claims
A geographic area of the public lands held under the general mining laws in which the right of exclusive possession is vested in the locator of a valuable mineral deposit.

Mitigation
Measures designed to counteract environmental impacts or to make impacts less severe. These may include: avoiding an impact by not taking a certain action or part of an action; minimizing an impact by limiting the degree or magnitude of an action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or compensating for the impact by replacing or providing substitute resources or environments.

Mixed Conifer
In Southeast Alaska, mixed conifer stands usually consist of western hemlock, mountain hemlock, Alaska yellowcedar, Western redcedar, and Sitka spruce species. Shorepine may occasionally be present depending on individual sites.

Model
A representation of reality used to describe, analyze, or understand a particular concept. A model may be a relatively simple qualitative description of a system or organization, or a highly abstract set of mathematical equations. A model has limits to its effectiveness, and is used as one of several tools to analyze a problem.

Monitoring
A process of collecting information to evaluate whether or not objectives of a project and its mitigation plan are being realized. Monitoring can occur at different levels: to confirm whether mitigation measures were carried out in the manner called for, to determine whether the mitigation measures were effective, or to validate whether overall goals and objectives were appropriate. Different levels call for different methods of monitoring.

Multi-entry Layout Process (MELP)
Computerized data base located in each area supervisor's office containing information on timber, transportation, and TLMP management goals. It is used for planning and economic analyses for the Forest Service administrative area.

Multiple-aged Stands
An intermediate form of stand structure between even and uneven-aged stands. These stands generally have two or three distinct tree canopy levels occurring within a single stand.

Multiple Use
The management of all the various renewable resources of the National Forest System to be used in the combination that will best met the needs of the American people.

Muskeg
In Southeast Alaska a type of bog that has developed over thousands of years in depressions or flat areas on gentle to steep slopes. Also called peatlands.

Mycorrhizae
A mutualism between plant roots and certain kinds of fungi. The plants exude carbon compounds to the fungi and the fungi provide the plants with soil nutrients, such as phosphorus.

National Environmental Policy Act (NEPA) of 1969
An Act to declare a national policy which will encourage productive and enjoyable harmony between humankind and the environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, to enrich the understanding of the ecological systems and natural resources important to the Nation, and to establish a Council on Environmental Quality (The Principal Laws Relating to Forest Service Activities, agric. Handb. 453. USDA Forest Service, 359 p.).

National Forest Management Act (NFMA)
A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act requiring the preparation of Regional Guides and Forest Plans and the preparation of regulations to guide that development.

National Wild and Scenic River System
Rivers with outstanding scenic, recreational, geological, fish and wildlife, historic, cultural, or other similar values designated by Congress under the Wild and Scenic Rivers Act of 1968 and amended in 1986, for preservation of their free-flowing condition. May be classified and administered under one or more of the following categories: Wild, Scenic, and/or Recreational.

Native Allotment
A tract of non-mineral land, not to exceed 160 acres, on which an Alaska Native (who was 21 year of age or head of a household) established continuous use and occupancy prior to the creation of the National Forests (authorized under the Native Allotment Act of May 17, 1906).

Native Selection
Application by Native corporations and individuals to a portion of the USDI Bureau of Land Management for conveyance of lands withdrawn in fulfillment of Native entitlements established under ANSCA.

Net Sawlog Volume
Trees suitable in size and quality for producing logs that can be processed into lumber. In Southeast Alaska, depending on the market, the volume may be processed as pulp or lumber.

No-action Alternative
The most likely condition expected to exist in the future if current management direction were to continue unchanged.

Non-commercial Forest Land
Land with more than 10 percent cover of commercial tree species but not qualifying as Commercial Forest land.

Noncommercial species
Species that have no economic values at this time nor anticipated timber value within the near future.

Nondeclining Even Flow
A policy governing the volume of timber removed from a National Forest, which states that the volume planned for removal in each succeeding decade will equal or exceed that volume planned for removal in the previous decade.

Non-Forest Land
Land that has never supported forests and lands formerly forested but now developed for such nonforest uses as crops, improved pasture, etc.

Notice of Intent (NOI)
A notice printed in the Federal Register announcing that an Environmental Impact Statement will be prepared. The NOI must describe the proposed action and possible alternatives, describe the agency's proposed scoping process, and provide a contact person for further information.

Objectives
The precise steps to be taken and the resources to be used in achieving goals.

Offering
A Forest Service specification of timber harvest units, subdivisions, roads, and other facilities and operations to meet the requirements of a contract.

Offering Area
A geographic area identified by the Forest Service within which the offering specifications are outlined. One or more offering areas may be identified within all or a portion of an a project area.

Old Growth
Ecosystems distinguished by old trees and related structural attributes. Old-growth forests are characterized by larger tree size, higher accumulations of large dead woody material, multiple canopy layers, different species composition, and different ecosystem function. The structure and function of an old-growth ecosystem will be influenced by its stand size and landscape position and context. For the displays in this project, it is those areas typed as Volume Class 4, 5, 6, and 7.

Organic Soils
Soils that contain a high percentage (generally greater than 20 to 30 percent) of organic matter throughout the soil depth.

Parent Material
The unconsolidated and partially weathered material (or the C Horizon) from which upper layers of soil developed.

Partial Cut
Method of harvesting trees where any number of live stems are left standing in any of various spatial patterns. Not clearcutting. Can include seed tree, shelterwood, or other methods.

Patch
A non-linear surface area differing in appearance from its surroundings.

Payments to States
A fund consisting of approximately 25 percent of the gross annual timber receipts received by the National Forests in that state. This is returned to the State for use on roads and schools.

Peak flow
The highest discharge of water recorded over a specified period of time at a given stream location. Often thought of in terms of spring snowmelt, summer, fall, or winter rainy season flows. Also called maximum flow.

pH
The degree of soil acidity or alkalinity.

Planning Area
The area of the National Forest System controlled by a decision document.

Planning Record
A system that records decisions and activities that result from the process of developing a forest plan, revision, or significant amendment.

Plant Association
Climax plant community type.

Plant Communities
Aggregations of living plants having mutual relationships among themselves and to their environment. More than one individual plant community.

Pole
An immature tree between 5 and 9 inches diameter breast height.

Population Viability
Ability of a population to sustain itself.

Potential Yield
The maximum, perpetual, sustained-yield harvest attainable through intensive forestry on regulated areas considering the productivity of the land, conventional logging technology, standard cultural treatments, and interrelationships with other resource uses and the environment.

Present Net Value (PNV)
The difference between the benefits and costs associated with the alternatives.

Prescribed Fire
A wildland fire burning under planned conditions to accomplish specific land and resource objectives. It may result from either a management or natural ignition.

Primary Stream Production
Results from photosynthesis by green plants. In streams, includes production from algae and aquatic plants, and from non-stream sources such as leaf litter.

Primary Succession
Vegetation development is initiated on newly formed soils or upon surfaces exposed for the first time (as by landslides) which have, as consequence, never borne vegetation before.

Process Group
A combination of similar channel types based on major differences in landform, gradient, and channel shapes.

Proportionality
The Tongass Timber Reform Act (TTRA 1990) modification of Alaska's Long-Term Timber Sale Contracts to eliminate the practice of harvesting a disproportionate amount of old-growth timber.

Public Participation
Meetings, conferences, seminars, workshops, tours, written comments, responses to survey questionnaires, and similar activities designed and held to obtain comments from the public about Forest Service activities.

Receipts
Those priced benefits for which money will actually be paid to the Forest Service: recreation fees, timber harvest, mineral leases, and special use fees.

Record of Decision
A document separate from but associated with an Environmental Impact Statement which states the decision, identifies all alternatives, specifying which were environmentally preferable, and states whether all practicable means to avoid environmental harm from the alternative have been adopted, and if not, why not.

Recreation Opportunity Spectrum (ROS)
Land delineations that identify a variety of recreation experience opportunities categorized into eight classes on a continuum from primitive to urban. Each class is defined in terms of the degree to which it satisfies certain recreation experience needs based on the extent to which the natural environment has been modified, the type of facilities provided, the degree of outdoor skills needed to enjoy the area and the relative density of recreation use. The eight classes are:

Primitive I: Includes areas out of sight and sound of human activities and greater than 3 miles from roads open to public travel and marine travel ways. Provides opportunities for a high-degree of interaction with the natural environment, challenge, risk, and the use of outdoor skills.

Primitive II: Area is similar in appearance to Primitive I ROS class; however, it is accessible by marine travel way or is within 1/4 mile of low-use trails.

Semi-Primitive Nonmtorized: Includes areas greater than 1/4 mile and less than 3 miles from all roads, trails, or readily accessible marine travel ways. Provides limited opportunities for isolation from the sights and sounds of humans and a high-degree of interaction with the natural environment. Moderate challenge, risk, and the opportunity to use outdoor skills.

Semi-Primitive Motorized: Includes areas less than 1/4 mile from primitive roads, trails, or readily accessible marine travel ways. Characterized by a predominately unmodified natural environment with minimum evidence of sights and sounds of humans. Road access is not maintained in these areas.

Roaded Natural: Areas are less that 1/4 mile from roads open to public travel, major power lines, and areas of timber harvest. Areas are characterized by predominantly natural environments with moderate evidence of sights and sounds of humans.

Roaded Modified: Areas are less than 1/4 mile from areas of timber harvest and transportation corridors. Areas are characterized by substantially modified natural environments. Sights and sounds of humans are readily evident.

Rural: Includes those areas with small communities, developed campgrounds, and administrative sites. These areas are characterized by substantially modified natural environments. Sights and sounds of humans are readily evident.

Urban: Areas characterized by substantially urbanized environment. The background may have elements of a natural environment. Timber harvest activities and utilization practices are common. Sights and sounds of humans predominant. Large numbers of visitors can be expected on site and in nearby areas.

Reforestation
The natural or artificial restocking of an area with trees.

Regeneration
The process of establishing a new crop of trees on previously harvested land.

Regional Forester
The Forest Service official responsible for administering a single region.

Regional Guide
The guide developed to meet the requirements of the Forest and Rangeland Renewable Resources Planning Act of 1974 as amended. It guides all natural resource management activities and establishes management standards and guidelines for the National Forest System lands within a given region.

Rehabilitation
Actions taken to protect or enhance site productivity, water quality, or other values for a short period of time.

Reserved Lands
Lands reserved from the public domain for National Forest purposes and lands which are added to the National Forest System by exchange for reserved National Forest lands.

Resident Fish
Fish that are not anadromous and that reside in freshwater on a permanent basis. Resident fish include non-anadromous Dolly Varden char and cutthroat trout.

Resource values
The tangible and intangible worth of forest resources.

Responsible Official
The Forest Service employee who has the delegated authority to make a specific decision.

Restricted Harvest
The action of apportioning the supply of a resource to specific uses or to particular persons or organizations.

Restoration
The long-term placement of land back into its natural condition or state of productivity.

Retention Factor
The amount of commercial forest land removed from the calculation of the ASQ as an allowance to protect other resource values. These factor allowances available to draw upon when meeting other resource needs and are not fixed policies to be rigidly applied by the interdisciplinary team or Forest supervisors.

Revegetation
The re-establishment and development of a plant cover. This may take place naturally through the reproductive processes of the existing flora or artificially through the direct action of reforestation or reseeding.

Riparian Area
Geographically delineable area with distinctive resource values and characteristics that contain elements of aquatic and riparian ecosystems.

Riparian Ecosystem
Land next to water where plants that are dependent on a perpetual source of water occur.

Roads

Arterial: Roads usually developed and operated for long-term land and resource management purposes to constant service.

Collector: Collects traffic from Forest local roads; usually connects to a Forest arterial or public highway.

Local: Provides access for a specific resource use activity such as a timber sale or recreational site, although other minor uses may be served.

Preplanned: Roads planned in a prior EIS.

Temporary: For National Forest timber sales, temporary roads are constructed to harvest timber on a one-time basis. These logging roads are not considered part of the permanent Forest transportation network and have stream crossing structures removed, erosion measures put into place, and the road closed to vehicular traffic after harvest is completed.

Roadless Area
An area of undeveloped public land within which there are no improved roads maintained for travel by means of motorized vehicles intended for highway use.

Rotation
The planned number of years (approximately 100 years in Alaska) between the time that a Forest stand is regenerated and its next cutting at a specified stage of maturity.

Rotation Age
The age of a stand when harvested at the end of a rotation.

RPA Assessment and Program
The RPA Assessment is prepared every ten years and describes the potential of the nation's forests and rangelands to provide a sustained flow of goods and services. The RPA Program is prepared every five years to chart the long-term course of Forest Service management of the National Forests, assistance to State and private landowners, and research. They are prepared in response to Sections 3 and 4 of the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) (16 U.S.C. 1601).

Salvage Sale
A timber sale to use dead and down timber and scattered poor-risk trees that would not be marketable if left in the stand until the next scheduled harvest.

Sawlog
That portion of a tree that is suitable in size and quality for the production of dimension lumber collectively known as sawtimber.

Scheduled Lands
Land suitable and scheduled for timber production and which are in the land base for the calculation of the allowable sale quantity and long-term sustained yield timber capacity.

Scheduled Timber Harvests
Timber harvests done as part of meeting the allowable sale quality.

Scoping Process
Early and open activities used to determine the scope and significance of a proposed action, what level of analysis is required, what data is needed, and what level of public participation is appropriate. Scoping focuses on the issues surrounding the proposed action, and the range of actions, alternatives, and impacts to considered in an EA or an EIS.

Scrub-Shrub Wetland
Wetlands dominated by woody vegetation less than 20 feet tall. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. In Southeast Alaska this includes forested lands where trees are stunted because of poor soil drainage.

Second Growth
Forest growth that has become established following some disturbance such as cutting, serious fire, or insect attack; even-aged stands that will grow back on a site after removal of the previous timber stand.

Secondary Stream Production
Results from consumption by animals of materials produced in primary production in streams; this includes production of macroinvertebrates and some fish species.

Secondary Succession
The process of re-establishing vegetation after normal succession is disrupted by fire, cultivation, lumbering, windthrow, or any similar disturbance.

Sediment
Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface.

Seed Tree
Small number of seed-bearing trees left singly or in small groups after timber harvest to provide seed for regeneration of the site.

Selective Cutting
The annual or periodic removal of trees (particularly the mature), individually or in small groups from an uneven-aged forest to achieve the balance among diameter classes needed for sustained yields, and in order to realize the yield, and establish a new crop of irregular constitution. Note: The improvement of the Forest is a primary consideration.

Sensitive Species
Plant and animal species which are susceptible or vulnerable to activity impacts or habitat alterations. Those species that have appeared in the Federal Register as proposed for classification or are under consideration for official listing as endangered or threatened species, that are on a non-official State list, or that are recognized by the regional forester as needing special management to prevent placement on Federal or state lists.

Sensitivity Level
A map inventory that measures peoples' concern for the scenic quality of the National Forests. In 1980, the Tongass National Forest assigned sensitivity levels to land areas viewed from anchorages, plane and boat routes, roads, trails, public-use areas, and recreation cabins.

Level I: Includes all seen areas from primary travel routes, use areas, and water bodies where at least three-fourths of the Forest visitors have a major concern for scenic quality.

Level II: Includes all seen areas from primary travel routes, use areas, and water bodies where at least one-fourth of the Forest visitors have a major concern for scenic quality.

Level III: Includes all seen areas form secondary travel routes, use areas, and water bodies where less than one-fourth of the Forest visitors have a major concern for scenic quality.

Seral
Early stage of succession.

Shelterwood Cutting
A harvest method in which most of the trees are removed in an initial entry and some trees are left to naturally reseed the area and provide protection to new seedlings that establish on the site. A second entry is conducted later to remove the remaining trees.

Silviculture
The science of controlling the establishment, composition, and growth of forests.

Single-tree selection
A cutting method to develop and maintain uneven-aged stands by removal of selected trees from specified age classes over the entire stand area in order to meet a predetermined goal of age distribution and species in the remaining stand.

Site Index
A measure of the relative productive capacity of an area for growing wood. Measurement of site index is based on height of the dominant trees in a stand at a given age.

Site Preparation
Manipulation of the vegetation or soil of an area prior to planting or seeding. The manipulation follows harvest, wildfire, or construction in order to encourage the growth of favored species. Site preparation may include the application of herbicides, burning, or cutting of living vegetation that competes with the favored species; tilling the soil; or burning of organic debris (usually logging slash) that makes planting or seeding difficult.

Site Productivity
Production capability of specific areas of land.

Slope Distance
Distance measured along the contour of the ground.

Smolt
Young silvery-colored salmon or trout which move from freshwater streams to saltwater.

Snag
A standing dead tree, usually greater than 5 feet tall and 6 inches in diameter at breast height.

Soil Productivity
The capacity of a soil, in its normal environment, to produce a specific plant or sequence of plants under a specific system of management.

Soil Quality Standards
Standards that are a combination of 1) "threshold" values for severity of soil property alteration, or significant change in soil properties conditions, and 2) areal extent of disturbance.

Soil Resource Inventory (SRI)
An inventory of the soil resource based on landform, vegetative characteristics, soil characteristics, and management potentials.

Special Habitats
Structural elements of ecosystems. These may include, but are not limited to: snags, spawning gravels, fallen trees, aquatic reefs, caves, seeps, and springs.

Special Use Authorization
A permit, term permit, temporary permit, lease, or easement that allows occupancy or use of, or rights and privileges on National Forest System lands.

Special Use Permit
Permits and granting of easements (excluding road permits and highway easements) authorizing the occupancy and use of land.

Specify
"Specify" means to approve an Offering in writing by issuance of an A Division for the Offering, for implementation in conformance with the other requirements of the contract.

Split Yarding
The process of separating the direction of timber harvest yarding into opposite directions.

Stand (Tree Stand)
An aggregation of trees occupying a specific area and sufficiently uniform in composition, age arrangement, and condition as to be distinguishable from the forest in adjoining areas.

Standard
A course of action or level of attainment required by the forest plan to promote achievement of goals and objectives.

State Historic Preservation Officer (SHPO)
State appointed official who administers Federal and State programs for cultural resources.

State Selection
Application by Alaska Department of Natural Resources to the USDI Bureau of Land Management for conveyance of a portion of the 400,000 acre State entitlement from vacant and unappropriated National Forest System lands in Alaska, under the Alaska Statehood Act of 1959 (Public Law 85-508, 72 Stat. 340).

Stocking
The degree of occupancy of land by trees as measured by basal area or number of trees and as compared to a stocking standard; that is, the basal area or number of trees required to fully use the growth potential of the land.

Stream Classes
See Aquatic Habitat Management Unit.

Stream Order
First order streams are the smallest unbranched tributaries; second order streams are initiated by the point where two first order streams meet; third order streams are initiated by the point where two second order streams meet, and so on.

Structural Diversity
The diversity of forest structure, both vertically and horizontally, which provides for a variety of forest habitats such as logs and multi-layered forest canopy for plants and animals.

Stumpage
The value of timber as it stands uncut in terms of dollar value per thousand board feet.

Subsistence
Section 803 of the Alaska National Interest Lands Conservation Act defines subsistence use as, "the customary and traditional uses by rural Alaska residents of wild renewable resources for direct, personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade."

Subsistence Use Area
Important Subsistence Use Areas include the "most reliable" and "most often hunted" categories from the Tongass Resource Use Cooperative Survey (TRUCS) and from subsistence survey data from ADF&G, the University of Alaska, and the Forest Service, Region 10. Important use areas include both intensive and extensive use areas for subsistence harvest of deer, furbearers, and salmon.

Substantive Comment
A comment that provides factual information, professional opinion, or informed judgement germane to the action being proposed.

Substrate
The type of material in the bed (bottom) of rivers and streams.

Succession
The ecological progression of community change over time, characterized by displacements of species leading towards a stable climax community.

Suitable
Commercial Forest land identified as having both the biological capability and availability to produce industrial wood products.

Suitable Forest land
Forest land for which technology is available that will ensure timber production without irreversible resource damage to soils, productivity, or watershed conditions, and for which there is reasonable assurance that such lands can be adequately restocked, and for which there is management direction that indicated that timber production is an appropriate use of that area.

Suspended Sediment
The very fine soil particles which remain in suspension in water for a considerable period of time without contact with the stream or river channel bottom.

Sustained Yield
The amount of renewable resources that can be produced continuously at a given intensity of management.

Swale
A slight, marshy depression in generally level land. A depression in glacial ground moraine.

Tentatively Suitable Forest Land
Forest land that is producing or is capable of producing crops of industrial wood and: (a) has not been withdrawn by Congress, the Secretary of Agriculture of the Chief of the Forest Service; (b) existing technology and knowledge is available to ensure timber production without irreversible damage to soils productivity, or watershed conditions; (c) existing technology and knowledge, as reflected in current research and experience, provides reasonable assurance that it is possible to restock adequately within 5 years after final harvest; and (d) adequate information is available to project responses to timber management activities.

Terrestrial Ecosystems
Plant communities that are not dependent on a perpetual source of water to grow.

Thinning
The practice of removing some of the trees in a stand so that the remaining trees will grow faster due to reduced competition for nutrients, water, and sunlight. Thinning may also be done to change the characteristics of a stand or wildlife or other purposes. Thinning may be done at two different stages.

Threatened Species
Plant or animal species which is likely to become endangered throughout all or a significant portion of its range within the foreseeable future, as defined in the Endangered Species Act of 1973, and which has been designated in the Federal Register by the Secretary of the Interior as a threatened species. (See also, endangered species, sensitive species.)

Threshold
The point or level of activity beyond which an undesirable set of responses begins to take place within a given resource system.

Tiering
Eliminating repetitive discussions of the same issue by incorporating by reference. The general discussion in an environmental impact statement of broader scope; e.g., this document is tiered to the Tongass Land Management Plan, as amended.

Timber Appraisal
Establishing the fair market value of timber by taking the selling value minus manufacturing costs, the cost of getting logs from the stump to the manufacturer, and an allowance for profit and risk.

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Timber Classification
Forested land is classified under each of the land management alternatives according to how it relates to be management of the timber resource. The following are definitions of timber classifications used for this purpose.

Nonforest: Land that has never supported forests and land formerly forested where use for timber production is precluded by development or other uses.

Forest: Land at least 10-percent stocked (based on crown cover) by forest trees of any size, or formerly having had such tree cover and not currently developed for nonforest use.

Suitable or suitable available: Land to be managed for timber production on a regulated basis.

Unsuitable: Forest land withdrawn from timber utilization by statute or administrative regulation (for example, wilderness), or identified as inappropriate for timber production in the Forest planning process.

Commercial forest: Forest land tentatively suitable for the production of continuous crops of timber and that has not been withdrawn.

Timber Dispersion
When an opening created from a final timber harvest is no longer considered an opening for the purpose of scheduling adjacent timber harvest. This is often expressed as the maximum amount of disturbance in a watershed at any given time.

Timber Harvest Unit
A "Timber Harvest Unit" is a portion of an Offering Area within which Forest Service specifies for harvest all or part of the timber to meet the requirements of this contract and designates as Included Timber under B2.3.

Timber Stand Improvement (TSI)
All noncommercial intermediate cutting and other treatments to improve composition, condition, and volume growth of a timber stand.

Tongass Land Management Plan (TLMP)
The 10-year land allocation plan for the Tongass National Forest that directs and coordinates planning, the daily uses, and the activities carried out within the forest. Currently under revision.

Tongass Resource Use Cooperative Survey (TRUCS)
A study on subsistence uses which was used for evaluating the effects of the proposed action in this EIS.

Turbidity
An indicator of the amount of sediment suspended in water.

Understory
The trees and shrubs in a forest growing under the canopy or overstory.

Uneven-Aged Management
Forest management techniques which simultaneously maintain continuous high-forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes. Cutting is usually regulated by specifying the number or proportion of trees of particular sizes to retain within each area, thereby maintaining a planned distribution of size classes.

Unscheduled Lands
Lands suitable but not scheduled for timber production and which are not in the land base for the calculation of the allowable sale quantity nor long-term sustained yield timber capacity.

Unsuitable
Forest land withdrawn from timber utilization by statute or administrative regulation; for example, wilderness, or identified as not appropriate for timber production in the forest planning process.

Utility Logs
Those logs that do not meet sawlog grade but are suitable for production of firm useable pulp chips.

VAC
See Visual Absorption Capability.

Value Comparison Unit (VCU)
Areas which generally encompass a drainage basin containing one or more large stream systems; boundaries usually follow easily recognizable watershed divides. Established to provide a common set of areas where resource inventories could be conducted and resource interpretations made.

Viable Population
The number of individuals of a species required to ensure the long-term existence of the species in natural, self-sustaining populations adequately distributed throughout their region.

Viewshed
An expansive landscape or panoramic vista seen from a road, marine water way, or specific viewpoint.

Visual Quality Objectives (VQO)
Measurable standards reflecting five different degrees of landscape alteration based upon a landscape's diversity of natural features and the public's concern for high scenic quality. The five categories of VQOs are:

Preservation: Permits ecological changes only. Applies to wilderness areas and other special classified areas. Management activities are generally not allowed in this setting.

Retention: Provides for management activities that are not visually evident to the casual Forest visitor.

Partial Retention: Management activities remain visually subordinate to the natural landscape.

Modification: Management activities may visually dominate the characteristics landscape. However, activities must borrow from naturally established form-line color and texture so that the visual characteristics resemble natural occurrences within the surrounding area when viewed in the middleground distance.

Maximum Modification: Management activities may dominate the landscape but should appear as a natural occurrence when viewed as background.

V-Notches
A deeply incised valley along some waterways that would look like a "V" from a cross-section. These abrupt changes in terrain features are often used as harvest unit or yarding boundaries.

Volume
Stand volume based on standing net board feet per acre by Scribner Rule.

Volume Class
Used to describe the average volume of timber per acre in thousands of board feet (MBF). The seven volume classes
include:

Classes 1 to 3: Less than 8 MBF/acre (cleared land, seedlings, or pole timber stands).
Class 4: 8 to 20 MBF/acre.
Class 5: 20 to 30 MBF/acre.
Class 6: 30 to 50 MBF/acre.
Class 7: 50+ MBF/acre.

Watershed
The area that contributes water to a drainage or stream. Portion of the forest in which all surface water drains to a common point. Watersheds can range from a few tens of acres that drain a single small intermittent stream to many thousands of acres for a stream that drains hundreds of connected intermittent and perennial streams.

Wetland
Areas that are inundated by surface or groundwater frequently enough to support vegetation that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include: swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mudflats, and natural ponds. See the TLMP Draft Revision (1991a) pgs. 3-423 and 3-424 for detailed discussion on wetland type definitions.

Wilderness
Areas designated by congressional action under the 1964 Wilderness Act. Wilderness is defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or humans habitation. Wilderness areas are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature, with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or a primitive and unconfined type of recreation; areas of at least 5,000 acres are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and may contain features of scientific, educational, scenic, or historical value as well as ecologic and geologic interest. In Alaska, Wilderness has been designated by ANILCA and TTRA.

Wildlife Analysis Area (WAA)
A division of land used by the Alaska Department of Fish and Game for wildlife analysis.

Wildlife Habitat
The locality where a species may be found and where the essentials for its development and sustained existence are obtained.

Wildlife Habitat Management Unit (WHMU)
An area of wildlife habitat identified during the IDT process as having values important to wildlife.

Windfirm
Trees that have been exposed to the wind throughout their life and have developed a strong root system or trees that are protected from the wind by terrain features.

Windthrow
The act of trees being uprooted by the wind. In Southeast Alaska, Sitka spruce and hemlock trees are shallow rooted and susceptible to windthrow. There generally are three types of windthrow:
Endemic: where individual trees are blown over;
Catastrophic: where a major windstorm can destroy hundreds of acres; and
Management Related: where the clearing of trees in an area make the adjacent standing trees vulnerable to windthrow.

Winter Range
An area, usually at lower elevation, used by big game during the winter months; usually smaller and better-defined than summer ranges.

Withdrawal
The withholding of an area of Federal land from settlement, sale, location, or entry under some or all of the general land laws for the purpose of limiting activities under those laws in order to maintain other public values in the area.

Yarding
Hauling timber from the stump to a collection point.

Yield Tables
Tables that estimate the level of outputs that would result from implementing a particular activity. Usually referred to in conjunction with FORPLAN input or output. Yield tables can be developed for timber volumes, range production, soil and water outputs, and other resources.

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Title 2400, *Timber Management*
Title 2500, *Watershed and Air Management, Chapter 2554 "Soil Quality Monitoring"*

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FSH 2409.18. *Timber Sale Preparation Handbook and R10 Supplement 6*
FSH 2409.18-92-5. *Region 10 Supplement to Timber Sale Preparation Handbook. Proportionality Analysis.*
FSH 2409.22. *Region 10 Timber Sale Appraisal Handbook (1994)*
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Distribution List

List of Agencies and Organizations to Whom Copies of this Draft Environmental Impact Statement Were Sent

Agencies and Organizations Sent Complete Copy of Draft EIS

Alaska Dept. of Environmental Conservation, Commissioner, Juneau, AK
Alaska Dept. of Fish & Game, Douglas, AK
Alaska Dept. of Fish & Game, Ketchikan, AK
Alaska Dept. of Fish & Game, James Durst, Klawock, AK
Alaska Dept. of Fish & Game, Jack Gustafson, Ketchikan, AK
Alaska Dept. of Fish & Game, Mike Haddix, Ketchikan, AK
Alaska Dept. of Fish & Game, Mathew Kirchhoff, Douglas, AK
Alaska Dept. of Fish & Game, Doug Larsen, Wildlife Biologist, Ketchikan, AK
Alaska Dept. of Fish & Game, Tom Paul, Douglas, AK
Alaska Dept. of Fish & Game, Robert E. Schroeder, Douglas, AK
Alaska Dept. of Fish & Game, Commissioner, Juneau, AK
Alaska Dept. of Natural Resources, Commissioner, Juneau, AK
Alaska Forest Association, Ketchikan, AK
Alaska Forest Association, Jack Phelps, Ketchikan, AK
Alaska Wilderness Recreation & Tourism Assoc., Juneau, AK
Alaskans for Responsible Resource, Sylvia Geraghty, Ketchikan, AK
Attorneys at Law, Ziegler Cloudy Peterson Woodell, Ketchikan, AK
Byron Brothers Cutting, James Byron, Ketchikan, AK
Central Council Tlingit and Haida, Joel Nudelman, Juneau, AK
Central Council Tlingit and Haida, Ed Thomas, Juneau, AK
City of Kasaan, Mayor, Kasaan, AK
City of Ketchikan, Mayor, Ketchikan, AK
City of Klawock, Mayor, Klawock, AK
City of Thorne Bay, Mayor, Thorne Bay, AK
Craig Advisory Committee, Cheryl Fecko, Craig, AK
Craig Public Library, Librarian, Craig, AK
Dept. of Commerce & Economic Development, Commissioner, Juneau, AK
DEC, Jim Ferguson, Juneau, AK
Div. of Governmental Coordination, Director, Juneau, AK
Federal Aviation Administration, Office of the Regional Director, Renton, WA
Federal Highway Administration, Regional Administrator, Reg. 10, Portland, OR
FERC, Enviro. Compliance Branch, Advisor on Environmental Quality, Washington, DC
General Services Administration, Office of Planning and Analysis, Washington, DC
Gildersleeve Logging Inc., Roger L. Gildersleeve, Ketchikan, AK
Greenpeace, Larry Edwards, Sitka, AK
Hydaburg Advisory Committee, Adrian LeCornu, Hydaburg, AK
Hydaburg Cooperative Association, Viola Burgess, Hydaburg, AK
Interstate Commerce Commission, Chief, Energy and Environment, Washington, DC
Island News, Editor, Thorne Bay, AK
Juneau Public Library, Librarian, Juneau, AK
Karst Research Group, Pete Smith, Ketchikan, AK
Ketchikan Public Library, Librarian, Ketchikan, AK

4 Lists

Ketchikan Pulp Co., Owen J. Graham, Ketchikan, AK
Ketchikan Pulp Co., Tom Hicks Planning & Eng Mngr, Ketchikan, AK
Ketchikan Pulp Co., Ralph Lewis, Ketchikan, AK
Ketchikan Pulp Co., Mr. Troy Reinhart, Ketchikan, AK
Klukwan Forest Products, Inc., Ronald R. Wolf, Juneau, AK
Klukwan, Inc., Johanna Hotch, Chairman, Juneau, AK
Koncor Forest Products, Dr. Geoffrey McNaughton, Anchorage, AK
Kootznoowoo, Edward Gamble, President, Juneau, AK
KPC Timber Division, Tom Twitchell, Thorne Bay, AK
Leslie Cutting, Inc., Jim Leslie, Wrangell, AK
Metlakatla Indian Community, Tribal Forester, Metlakatla, AK
Mitkof Lumber Company, Gerry Engel, Petersburg, AK
National Marine Fisheries Service, Director, Juneau, AK
Naval Oceanography Division, Attn. Ms. Linda Glover, Washington, DC
NEPA Compliance/EIS Filing Section, US Environmental Affairs Office, Washington, DC
NOAA Ecology & Conservation Office, Washington, DC
Prince of Wales Conserv. League, Jerry Sharrard, Chairperson, Craig, AK
Prince of Wales Logger's League, Lester W. Looney, Craig, AK
Robertson, Monagle and Eastaugh, Attorneys at Law, Juneau, AK
Rural Development Administration, Director, Klamath Falls, OR
SE AK Regional Subsistence Council, Vickie LeCornu, Craig, AK
SEACC, Buck Lindekugel, Juneau, AK
Sealaska Corporation, Robert Loescher, Juneau, AK
Sealaska Timber, Ketchikan, AK
Seley Corporation, Attn: Tim Droke, Ketchikan, AK
Sierra Club Legal Defense Fund, Tom Waldo, Juneau, AK
Sitka Ranger District, Ted Allio, Sitka, AK
Society of American Foresters, Chair S.A.F., Ketchikan, AK
Soil Conservation Service, Enviro. Coor. of Ecol. Scie. Div., Washington, DC
Sunny Cove Property Owners Assoc., Karen Hines, Ketchikan, AK
Tongass Conservation Society, Meg Cartwright, Ketchikan, AK
US Army Engr. Division, North Pacific (CENPD), Portland, OR
US Coast Guard, Environmental Impact Branch, Marine Envir. & Prot. Div., G-MEP, Washington, DC
US Dept. of Energy, Director, Office of Environmental Compliance, Washington, DC
US Dept. of Housing and Uban Development, Environmental Officer, Seattle, WA
US Dept. of Transportation, Assistant Secretary for Policy, Washington, DC
US Environmental Protection Agency, EIS Review Coordinator, Seattle, WA
US Navy, Enviro. Protection Division, Office of Chief of Navy Operations, Washington, DC
USDA Forest Service - Tongass NF, Regional Forester Phil Janik, Juneau, AK
USDA Forest Service - Tongass NF, Craig Ranger District, District Ranger, Craig, AK
USDA Forest Service - Tongass NF, Ketchikan Ranger District, District Ranger, Ketchikan, AK
USDA Forest Service - Tongass NF, Thorne Bay Ranger District, District Ranger, Thorne Bay, AK
USDA National Agricultural Library, Head, Acquisitions & Serials Branch, Beltsville, MD
USDI Fish & Wildlife Service, Ketchikan, AK
USDI-Fish & Wildlife Service, Vickie Davis, Ketchikan, AK
USDI Fish & Wildlife Service, Nevin Holmberg, Juneau, AK
USDI, Office of Environmental Affairs, Director, Washington, DC

Agencies and Organizations Sent Summary of Draft EIS

Alaska Dept. of Fish & Game, Juneau, AK
Alaska Loggers Assoc., Bruce Shepard, Hoonah, AK
Alaska Lumberman's Assn., Cliff Skillings, General Mgr, Ketchikan, AK
Alaska Marine Highway, Werner Sund, Ketchikan, AK
Alaska Society of Forest Dwellers, Joseph D. Sebastian, Point Baker, AK
Alaska Woods Service Company, Eric Muench, Ketchikan, AK
ANB Grand Camp President, Ron Williams, Juneau, AK
Attorneys, Robertson, Monagle & Eastaugh, Juneau, AK
Black Bear Cedar Products, James Murchy, Thorne Bay, AK
Cape Fox Corporation, Robert Major, Ketchikan, AK
Central Council Tlingit & Haida, Edward Thomas, President, Juneau, AK
City of Craig, Mayor, Craig, AK
City of Hydaburg, Director, Hydaburg, AK
City of Hydaburg, Mayor, Hydaburg, AK
Construction Machinery, Inc., Robert B. Elliot, Ward Cove, AK
Craig Advisory Committee, Jim Dennis, Craig, AK
Craig Advisory Committee, Pat Gardner, Craig, AK
Craig Advisory Committee, Duane James, Craig, AK
Craig Advisory Committee, Charles Jones, Craig, AK
Craig Advisory Committee, Greg Shapley, Craig, AK
Craig Community Association, Fred Hamilton, Jr., Craig, AK
Craig Community Association, Ralph Macki, President, Craig, AK
Craig Community Association, Tom Mills, Craig, AK
Craig Community Association, Jeff Sheakley, President, Craig, AK
Craig Community Association, Pam Sheakley, Craig, AK
Craig Community Association, Marlene Sprague, Craig, AK
Craig Tlinget & Haida Com. Council, Millie Stevens, President, Craig, AK
Edna Bay Advisory Committee, Judy Slattery, Edna Bay, AK
El Capitan Logging, Bill Menish, Ketchikan, AK
Goldbelt, Inc., Joe Beedle, President, Juneau, AK
Good Wood Productions, Hank Nelson, Craig, AK
Great Alaska Cedar Works, Inc., A. M. & Carol Johnson, Ketchikan, AK
Greater POW Chamber of Commerce, Bond Stewart, Craig, AK
Greens/Green Party USA Wildlands, Lionel Treepanier, Chicago, IL
Haida Corp., John E. Bruns, President, Hydaburg, AK
Haida Corp., Bruce Cook, CEO, Hydaburg, AK
Haida Society, Charles Edwardsen, Vice Pres., Ketchikan, AK
Haida Tribe, Tom Morrison, Hydaburg, AK
Hollis Community Action Council, Susan K.D. Page, Hollis, AK
Hollis Community Council, Mark Howey, Hollis, AK
Huna Totem Corporation, Roger D. Snippen, CEO, Juneau, AK
Hydaburg Advisory Committee, Glen Douglas, Hydaburg, AK
Hydaburg Advisory Committee, Gerard Helgesen, Hydaburg, AK
Hydaburg Advisory Committee, Donald Natkong, Hydaburg, AK
Hydaburg Coop. Association Council, Frank Alby, Hydaburg, AK
Hydaburg Coop. Association Council, John Carle, Hydaburg, AK
Hydaburg Coop. Association Council, Ethel Edenshaw, Hydaburg, AK
Hydaburg Coop. Association Council, Bert Nathan, Hydaburg, AK

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Hydaburg Coop. Association Council, Charles Natkong, Hydaburg, AK
Hydaburg Coop. Association Council, Theodore Peele, Hydaburg, AK
Hydaburg Cooperative Association, Robert Sanderson, President, Hydaburg, AK
Hydaburg Tlingit and Haida Com., Lisa Lang, Hydaburg, AK
Kavilco, Incorporated, Louis A. Thompson, President, Seattle, WA
Ketchikan Advisory Committee, Richard & Kay Andrew, Ketchikan, AK
Ketchikan Advisory Committee, Fred, Cheryl Athorp, Ketchikan, AK
Ketchikan Advisory Committee, Larry Painter, Ketchikan, AK
Ketchikan Advisory Committee, Charles Piercy, Ward Cove, AK
Ketchikan Cutting Co., John Gabriel, Ketchikan, AK
Ketchikan Daily News, Lew Williams III, Ketchikan, AK
Ketchikan Fish/Game Advisory Comm., Terry Pyles, Ketchikan, AK
Ketchikan Indian Corporation, George A. Carnes, Ketchikan, AK
Ketchikan Pulp Company, Stewart Phil, Ketchikan, AK
Klawock Advisory Committee, Harlan Buoy, Klawock, AK
Klawock Advisory Committee, Mac Demmert, Klawock, AK
Klawock Advisory Committee, Skip Fabry, Klawock, AK
Klawock Advisory Committee, John Skan, Klawock, AK
Klawock Advisory Committee, Ernest Smith, Sr., Chairman, Klawock, AK
Klawock Cooperative Assoc., Rosanne Demmert, President, Klawock, AK
Klawock Fish and Game Advisory Com, Klawock, AK
Klawock Heenya Corporation, Henrietta Kato, President, Klawock, AK
Klawock Timber Alaska, Inc., Brian Tyler, Klawock, AK
Klawock Tlingit and Haida, James Martinez, President, Klawock, AK
Klawock Tribal, Byron V. Skinna, Sr., Klawock, AK
Klukwan Forest Products, Ronald R. Wolfe, Juneau, AK
Kootznoowoo, Bob Manning, CEO, Juneau, AK
Louisiana Pacific Corporation, Martin R. Pihl, Ketchikan, AK
Mayor of Metlakatla, Metlakatla, AK
Metlakatla Indian Community, Mayor Ted Littlefield, Metlakatla, AK
Metlakatla Tlingit & Haida Council, Burlington Wellington, President, Metlakatla, AK
Mitkof Lumber CO., INC., President, Petersburg, AK
Organized Village of Saxman, Joe Williams II, Ketchikan, AK
Port Protection Community Assoc., Ed Mura, Point Baker, AK
Prince of Wales Lodge, Will Jones, Klawock, AK
Reid Brothers Logging & Const. Inc, Petersburg, AK
Representative, Bill Williams, Ketchikan, AK
Saxman Tlingit and Haida Council, Sharon Seirup, President, Ketchikan, AK
SE AK Regional Sub. Adv. Council, William Thomas Sr., Chair, Ketchikan, AK
SE AK Regional Subsistence Council, Dewey Skan, Klawock, AK
SEALASKA Corp, Leo Barlow, CEO, Juneau, AK
Sealaska Corp., Allen Williams, Chairman, Juneau, AK
Sealaska Timber Corporation, Robert Girt, Ketchikan, AK
Shaan-Seet, Inc., Paul Lingley,President, Craig, AK
Shuham & Milner, CPA's (PC), Scott Milner, Ketchikan, AK
Soderberg Logging & Construction, K. A. Soderberg, Ketchikan, AK
South Coast, Inc., Don Thornlow, Ketchikan, AK
Southeast Stevedoring Corporation, Cliff R. Taro, Ketchikan, AK
Stand Up!, K. A. Swiger, Executive Director, Ketchikan, AK
Tongass Tribal Council, Bea Watson, President, Ketchikan, AK

Tongass Tribe, Ester Shea, Ketchikan, AK
Tsimpshian Tribal Association, Verna Hudson, President, Ketchikan, AK
Tsimpshian Tribal Council, John Reese, Ketchikan, AK
Tuxekan Logging, John King, Ketchikan, AK
Tuxekan Logging, Tuxekan Crew et. al, Ketchikan, AK
Whale Pass Residents Association, , Dennis Parker, Ketchikan, AK
Wrangell Forest Products, Steve Seley, Ketchikan, AK
Wrangell Forest Products,Winston Smith, Ketchikan, AK

List of Individuals to Whom Copies of this Draft Environmental Impact Statement Were Sent

Individuals Sent Complete Copy of Draft EIS

Anderson, Annette
Barlow, Gary
Canterbury Jackie
Castle, Brian
Connelly, Steve
Hastings, Ben, Judy, & Lizzy
Kathleen, Nola
Lewis, Steve
Myren, Dick
Naslund, Dave
Paulson, Bruce
Reinhart, Troy
Rhodes, Doug
Shoaf, Bill
Stecklein, Joe
Ziesak, Roger

Individuals Sent Summary of Draft EIS

Adamire, Buckley L.
Adams, Farrell & Lawna
Anglin, Gregory P.
Ashe, Mike
Ballard, Ernesta & W. Fisher
Barton, Donald G.
Bass, Lonnie
Belk, Barney
Benner, Clayton R.
Bennett, Fred P.
Bethel, Mitch
Betzina, Sue
Bigelow, Mrs. L.C.
Bloom, Robert A.
Booth, Robert A.
Brady, Len
Brown, Mike
Buss, Wesley
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Carns, George
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Cochran, Kenneth L.
Cook, H. R
Cowan, Raymond D.
Craig, Tom
Crisp, Jeff
Crumpton, Debbie
Dale, Ralph
Durrette, Corey
Durrette, Jacqueline
Eads, Ernie
Erickson, Richard
Ferguson, James L.
Fifield, David
Filbert, Bill
Finney, D. L.
Fitzgerald, Jeanieva R.
Flynn, Kurt
French, Kathleen C.
Funk, Kent
Gardner, John
Gregg, Douglass
Griffin, Mr. & Mrs. Frank J.
Gronlund, Derek
Guest, Bob & Carol
Hannan, Ellen
Harris, Authur Lee
Harris, Leslie
Harris, Lee
Harrison, N.K.
Heath, Charlanne
Helton, Lloyd C.
Hendricks, C.R.
Hendrickson, Wayne
Hepokoski, Jim
Hohorst, Tim
Holm, Patrick
Huff, William D.
Huxtable, Sharon
Ingman, Joey C.
Isley, Elzie
Jensen, Joseph E.
Johnson, Douglas L.
Johnson, John
Johnson, Theodore
Jones, Jerry
Kelley, Michael W.
Kero, Jim
Kilanowski, Jerry
Knapp, Vivian
Knudson, Timothy
Kouni, Mike
Kushnick, Matilda
Lingenfelter, Stephen C.
Lisac, Jennifer L.
Long, Bob
Love, David
Mackie, Representative Jerry
Marsden, Jim
McCloud, Marvin
McDonald, Patrick J.

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McLane, John
Meredith, Steve
Meske, Sandra J.
Miller, Rena
Mooney III, Mr. & Mrs. H. R.
Moore, Kevin
Murkowski, Senator Frank
Nelson, Gordon
Nelson, Hyrum
Nelson, Les
Newland, James
Newport, Daniel M.
Normand, Arthur
Nugent, Sue
Olivadoti, J. Troy
Owens, Dave
Parker, Lynda
Pieper, Paul S.
Preston, Erin
Preusser, Ronald E.
Puett, Tim
Purdy, Scott F.
Randrup, Joel
Reinhart, Arnold
Reno, James
Reno, Leslie
Rice, Gary L.
Rieves, Mike & Cindy
Robinson, L. Scott
Romine, Bruce
Ross, Michael J.
Ross, Rachel M.
Rovlet, Jean P.
Sallee, Mike
See, Jim & Kathy
Sellard, Don D.
Sharp, Dan
Simmons, Patrick
Sinclair, Mr. Duane
Singer Jr., William
Smith, J.
Snyder, Monte R.
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Stallings, Shelley
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Stevens, Senator Ted
Storie, Mr. & Mrs. John A.
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Taylor, Senator Robin
Thompson, Bradley C.
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Urbania, John
Visitacion, Rolando
Waddel, Jeff
Walker, Rocky
Wasserman, Harry
White, Allen
White, John E.
Whitten Jr., Mr. & Mrs. Billy
Williams, Marietta
Williams, Dan & Liz
Wilson, Nathan J.
Woolery, Eric A.
Yoder, Lyle
Young, Honorable Don
Zadina, Lauri L.

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